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EXTRACTS FROM THE ANNUAL REPORT OF THE ISTHMIAN CANAL COMMISSION.

Hon. Luke E. Wright, Secretary of War, Washington, D.C.

Sir: I have the honor to submit, on behalf of the Isthmian Canal Commission, its annual report for the fiscal year ended June 30, 1908.

CONSTRUCTION AND ENGINEERING.

The organization of the department of construction and engineering is given in detail in the last annual report of the commission.

Under the organization as it existed buildings were erected, roads built, and sanitary ditches dug or constructed in the same territory in which canal work was in progress, but in each specific instance, under a separate head; the results were not always satisfactory.

In order to concentrate authority, to expedite the transaction of business, to secure proper coordination, to fix definitely the responsibility in any particular case, and to reduce the cost of administration, a complete reorganization was undertaken toward the close of the fiscal year, to be effected gradually, beginning July 1, by which all construction work, in any given district, irrespective of its character, would be placed under one head.

To accomplish the objects sought, the zone was divided into three parts, each of which is to constitute a division under the department of construction and engineering, the division engineers reporting direct to the chief engineer. The first is to include all territory north of Tabernilla, to be designated the Atlantic division; the second is to extend from Tabernilla to Pedro Miguel, to be named the central division, and the third, extending from Pedro Miguel to deep water in the Pacific, will constitute the Pacific division.

EXCAVATION AND DREDGING.

To the equipment for excavation in the dry, reported on hand at the close of the last fiscal year, fourteen 70-ton steam shovels, sixteen 95-ton steam shovels, 292 Lidgerwood cars, and 668 12-yd. dump cars were added by receipt or purchase during the year. With the addition of 200 dump cars, it is anticipated that the locomotives, steam shovels, and cars on hand or under order will be sufficient to complete the work to be done by this class of equipment.

Culebra Division.—This devision extended from the Chagres River in the vicinity of Gamboa to include the Pedro Miguel lock, a distance of 9.2 miles; the total amount of material excavated in the Culebra division during the year was 12,065,138 cu. yds., place measurement, of which 11,685,253 cu. yds. were from the canal prism and the balance for accessory works. The total number of steam shovels assigned to this part of the work during the year was 79.

As practically all the areas suitable for dumps within the limits of the division were utilized to their fullest capacities, the greater part of the material was hauled over the main line of the Panama Railroad to Gorgona and Tabernilla on the north and to the new dumps at Miraflores and La Boca on the south, the average haul being about 10 miles. Rock from the "cut" at Bas Obispo has been taken to Gatun, and since March 20, 1908, about 1,300 cu. yds. daily have been deposited on the south toe of the dam between the lock site and the temporary spillway, forming part of the dam.

On Oct. 4 the Cucaracha slide, which had caused more or less inconvenience since the work was begun by the French in 1884, started to move toward the east edge of the canal at a rate, at first of 14 ft. in 24 hours, decreasing toward the close of the month to about 4 ft.

LOOKING SOUTH THROUGH THE CULEBRA CUT, FEBRUARY, 1908.

in the same period of time. About 113,000 cu. yds. of material moved so as to effectually stop the transportation of material through the "cut" to the south, and necessitated the handling of all material over the single-track portion of the Panama Railroad via Empire to the south. Work was prosecuted day and night, by steam shovels and improvised hydraulic means, and by the end of the month sufficient space was gained on the moving mass to permit the passage of dirt trains to the south over the old route. The total area of the slide was approximately 34,455 sq. yds., and it was estimated that about 600,000 cu. yds. were in motion. The removal of this slide is not a source of difficulty in the dry season. A wide berm was left with the hope that should rapid movement again take place, steam shovels could prevent the interruption of traffic.

The slide at Parasio, another which developed when the French were at work on the canal, gave trouble in April of this year. It is located on the east bank of the canal and extends up a narrow gorge for about 750 ft. from the edge of the canal. The estimated area is 16,700 sq. yds., and the amount in motion is about 140,000 cu. yds., of which about 90,000 cu. yds. have been removed.

Two slides developed in the dry season along the upper level of Culebra "Cut." One is situated on the west bank of the canal at the village of New Culebra, which is built on one of the French dumps. The most distant point of the slide from the "cut" is about 420 ft.; the area is approximately 6,110 sq. yds. and about 50,000 cu. yds. of material are in motion. The other slide is located nearly opposite the village of Las Cascadas, on the east bank of the canal and extends back from the edge of the canal for a distance of about 230 ft. The area of this slide is estimated to be 5,433 sq. yds., and about 100,000 cu. yds. of material are in motion.

At the new Culebra station a sinking of the ground surface west of the west slope of the "cut" was noticed and a corresponding uplift of the bottom of the "cut" took place. A similar action of the bottom occurred in the canal just south of Gold Hill. In both instances this upward movement of the bottom was stopped by removing the material on the upper levels, whereby the pressure was reduced.

Chagres Division.—This division covered a distance of about 23 miles and extended from Gatun to a point where the canal crosses the Chagres River at Gamboa. The river crosses the canal line 23 times within the limits of this division, so that during construction a considerable portion of the prism is subject to overflow by floods, and to such an extent that progress of work is liable to be slow during the rainy seasons.

The surveys reported as in progress in the last annual report were completed, and the center line of the canal permanently marked. Slight changes in the alinement were made in the final location whereby a saving of 1,264,700 cu. yds. was effected; of this, 264,300 cu. yds. were rock. These surveys show that the total amount to be removed from this part of the canal prism is 12,256,300 cu. yds., of which 8,313,500 cu. yds. are earth and the balance rock.

The total amount of material excavated was 1,774,124 cu. yds., place measurement, all from the canal prism.

The total number of steam shovels in operation in this division was 15 and the balance of the equipment is largely that left by the French; 47 out of a total of 50 engines in use are French, as are 410 of the 645 dump cars.

Colon Dredging Division.—Dredging during the year was done by two French ladder dredges, two dipper dredges, the 16-in. suction dredge, and by the seagoing suction dredge "Ancon." A total of 5,087,623 cu. yds. of material was removed, of which 4,947,330 cu. yds. were from the canal prism and the remainder from accessory works.

The enlargement of the dry dock begun during the previous fiscal year was completed, making it capable of taking a vessel 298 ft. long, 50-ft. beam, and 15-ft. draft.

La Boca Dredging Division.—The quantity of material

to be removed is estimated at 29,212,700 cu. yds., at least 1,500,000 cu. yds. of which is rock. The purchase of a drill scow and one Lobnitz rock breaker for breaking up the rock so that it can be handled by the dredges was arranged, and the results of the experiments with these two machines will determine the method of removal finally adopted.

With the abandonment of the lock site at Lo Boca, a slight change in the alinement of the new channel was made, so as to utilize the present wharves of the Panama Railroad Co., as well as the dredging already done under the former project and by the French. With the exception of a small cut made by the dipper dredge, all excavation done under the original plan is within the limits of the new channel.

There have been used on this stretch of the canal the seagoing suction dredge "Culebra," which went into commission on Jan. 1, and four French ladder dredges. The dipper dredge was taken out of commission on Jan. 17, 1908, as not suitable for handling the soft material, and will be utilized later in the removal of rock. During the fiscal year a total of 5,273,360 cu. yds. was removed.

LOCKS AND DAMS.

The locks are in pairs, and since the compilation of the last annual report the projected dimensions have been increased so that the width in the clear will be 110 ft., the usable length remaining, as heretofore, 1,000 ft. The question of increasing the width was raised by the General Board of the Navy, in a memorandum to the Secretary of the Navy, dated Washington, Oct, 29, 1907, setting forth "that the width of the locks as now fixed, namely, 100 ft., is insufficient for probable ships of future construction, and that sound policy would dictate an increase to a clear width of 110 ft."

While the commission, after due consideration, was of the opinion that the width already adopted for the locks—100 ft. in the clear—was ample for all commercial vessels building or contemplated, and sufficient for any battleship constructed, building, or projected, it felt that the wishes of the Navy, as expressed by the General Board, should be followed, there being no insuperable obstacles, and it accordingly recommended that the project be modified as desired. This modification was approved by the President, under date of Jan. 15, 1908.

The project prepared by the minority members of the board of consulting engineers for the lock type of canal provided for a flight of three locks at Gatun, a flight of two locks at La Boca, and one at Pedro Miguel. The locks at La Boca were placed on the west side of Sosa Hill, and were to overcome the difference of the level between the ocean and a lake formed by the Sosa-Corozal and the Sosa-San Juan dams. Steps were taken to construct the former of these dams in accordance with the proposed plan, and trestles were built along the toes from which to dump material from Culebra cut. The trestles failed after the dumping from them began, and the material overlying the rock moved laterally, carrying the superimposed mass with it. In places this lateral motion continued for two weeks after dumping had stopped. The ground on either side of, and for some distance from, the dump was forced up, forming mounds of mud, the crests of which gradually approached the level of the dump proper. After an equilibrium was established between the dump and the adjacent mounds the hump or wave would again move out when the track was shifted toward it, accompanied by a sudden vertical settling of the track of 6 to 10 ft. when loaded trains were applied. Dumping from trestles of less height secured no better results.

When the difficulty developed, investigations by borings and test pits were made to determine the character of material overlying the rock. It was found to be, for the greater part, an unctuous blue clay without grit, possessing very little supporting power, instead of a stiff clay, as indicated on the profiles. The depth of rock below the surface varied from 10 to 70 ft., and in order to build the dams more money and time would be required than had been estimated.

When this became evident, a careful examination of the canal route from Pedro Miguel to the Pacific was undertaken, by wash and diamond drill borings and test pits, to ascertain if a more suitable place for the locks and dams could be found. In making these examinations care was taken to secure samples of the materials to be encountered at the various depths, as well as cores of the rock for depths of 25 ft. below the foundation level of the lock walls.

A study of the data thus obtained led to the conclusion that one lock at Pedro Miguel and two at Miraflores offered the most economical and desirable solution. The advantages of this plan over the then existing project were that dams of lower height, less length, and resting on rock comparatively near the surface could be more easily constructed and could be completed at an earlier date; and finally that the locks in this location would be protected against all possibility of distant bombardment and would be less exposed to gunboat or torpedo boat attack. As a consequence, the commission recommended a change in the project, which received the approval of the President on Dec. 19, 1907.

Gatun Locks.—The borings previously made to determine the character of the foundation for the locks developed the existence of strata of varying materials, and investigations were continued during the year to ascertain the depths of the strata and to determine also whether suitable material extended sufficiently far below the level on which the lock walls are to be built to carry the weight; a depth of 50 ft. below this level was fixed and the borings were so made. The materials encountered may be briefly summarized as a layer of argillaceous sandstone, overlying a layer of conglomerate which is composed of pebbles and other hard aggregates held together by a cementing material, and which subsequent excavation shows to be hard enough in texture to require blasting for its removal. Soft sandstone is next in order, consisting of sand with some cementing material, easily disintegrating under erosion. At the upper end volcanic tufa, with scattering pieces of argillaceous sandstone, is found, the proportion of tufa in this stratum diminishing toward the lower or north end of the site. Below this layer is dense argillaceous sandstone of considerable thickness.

The borings disclosed the presence of ground water, under pressure, in some of the conglomerate and through the stratum of soft sandstone, and investigations developed an underground flow through the sandstone, the source of supply being apparently ground water from the hills to the southeast and at a considerably higher elevation than the lock site. The indications are that the flow is about parallel to the axis of the lock. The volume of water encountered is small. There is no question that the various materials will bear the greatest loads that will be transmitted to them by the lock walls, if provision is made to prevent the underground flow of water through the softer materials on which part of the walls will rest.

It is intended now to prevent access to the foundation of this water by means of curtain walls connected with the underlying impervious stratum of argillaceous sandstone, and additional precautions will be taken if developments during construction make such measures desirable or necessary.

The excavation for the locks was continuous throughout the year, and nine shovels were assigned to this work. The total amount removed from the site was 1,769,115 cu. yds., of which 190,013 cu. yds. were deposited on the south toe of the dam, from the crossing of the Chagres River to the temporary spillway; 69,432 cu. yds. were deposited on the west side of the lock, making a fill for the operation of the construction plant, and the remainder was dumped as an embankment on the relocation of the Panama Railroad.

Gatun Dam.—Investigations, primarily undertaken to verify data already on hand concerning the character of material for the foundation of the dam, were continued for the purpose of determining more fully the character and extent of the various materials composing foundations for the dam and the spillway; for ascertaining whether there were any permeable connections between the swamp areas to the north and south of the site through the deposits in the gorges across which the dam will be built; for testing the ability of the material to support the proposed structure, and for learning whether suitable material for the dam can be had in the immediate vicinity. A test pit, 12 ft. square, was sunk in the hill through which the spillway is being cut and near its head, and this has been carried down to about 35 ft. below sea level. The rock formation here is practically the same as that at the lock site. On Gatun Island a test pit 20 ft. square was sunk to a depth of 68 ft. below sea level. Wash borings were resorted to, but care was taken to secure drive samples whenever there were indications of any change in the character of the material.

EXCAVATION ON THE SITE OF THE SPILLWAY AT THE GATUN DAM, JUNE, 1908.

The examinations made of the spillway indicate that the rock is of sufficient strength to bear safely any of the loads that will be placed upon it and that the principal water-bearing mediums are the fissures through the various strata, which allow the passage of water; this flow will be cut off, as in the case of the locks, by means of curtain walls properly constructed and connected with the impervious layer underlying the soft rock.

Both the test pit and the borings over the other portions of the dam site indicate that the top layer is a fine sand with a large proportion of clay intermixed. This extends to a maximum depth at one point of approximately 80 ft. Underlying this, for a distance of 100 ft. or more, is a thick marine deposit of blue clay containing a little sand, and in some parts a considerable quantity of shells; this material is impervious. Under this and directly overlying the rock is a deposit, varying in thickness up to 20 ft., of small boulders and gravel consolidated and cemented together with finely divided clays and silts. What seepage there is occurs in the top stratum; and though this is small, it is proposed to cut it off by sheet piling projecting up into the core of the dam and down into the impervious layer. The material encountered is of such character as to be amply strong for supporting the proposed structure. Examination by wash borings in the valleys above and below the site of the dam develops the fact that suitable material for dam construction can be readily procured by dredging and that the quantity available is amply sufficient for the purpose.

Two experimental dams, with dimensions corresponding to the dam as it is to be built, were made on the scale of 1 in. to the foot; the first by depositing all material from the north side and allowing the water to drain

south, by which the coarser material was deposited on the downstream side and the finer material on the upper side of the dam. This was tested for seepage under a full head of water, and the results are recorded in Appendix E. Another dam to the same scale was constructed by depositing the material at the same time on both the upstream and downstream sides, allowing the finer material to deposit toward the center. These experiments show not only the suitability of the available material, but that a stable and water-tight dam can be built by hydraulic methods.

Construction work at the dam during the year consisted in the removal of 918,920 cu. yds. of material from the spillway channel. This channel is 300 ft. wide, with a flare to 500 ft. on the upstream side, and it was decided to maintain the elevation of its bottom at the south end at 10 ft. above sea level, so as to preserve as thick a layer as possible of argillaceous sandstone over the conglomerate.

MOTIVE POWER AND MACHINERY, MUNICIPAL ENGINEERING, AND BUILDING CONSTRUCTION.

Motive Power and Machinery.—At the close of the year 2,200 men were carried on the rolls, and the expenditures amounted to $5,645,622.18. Three shops, located at Gorgona, Empire, and Paraiso, handle all work except electrical installations, and each is charged with the maintenance and operation of engine-houses, coal chutes, and air-compressor plants in its territory.

With the completion of all authorized work, the Gorgona shops will have 307,000 sq. ft. of floor space, the Empire shops 198,000 sq. ft., and the Paraiso shops 41,000 sq. ft.

At the Gorgona shops repairs are made to locomotives, unloaders, spreaders, and wooden car equipment, and such foundry and manufacturing work done as is necessary. Practically one-third of the output was manufactured material, including 4,279,237 lbs. of gray-iron castings, 50,000 lbs. of semisteel castings, and 216,947 lbs. of brass and bronze castings. Gray-iron castings cost, for labor and material, $0.0359 per lb. and brass castings $0.1951 per lb., including the cost of 1,462 patterns.

The Empire shops perform general repairs to steam shovels, steel car equipment, rock drills, and similar excavating machinery. Of the 101 steam shovels in service during the year, 55 were given general shop repairs, costing $145,479 for direct material and labor charges. As the steam-shovel excavation was 17,467,161 cu. yds., the cost of general shop repairs to steam shovels, per cubic yard, was $0.00833. The cost of field, or running repairs, to steam shovels, which, since Dec. 1, 1907, were handled by the respective division engineers, was for the entire year $263,554, or $0.01509 per cu. yd. for direct labor and material charges. At the air-compressor plants operated by these shops, 275,000,000 cu. ft. of air were compressed per month, the cost in June, 1908, being $0.0344 per 1,000 cu. ft.

Municipal Engineering.—The work of this division consisted of the completion of the water-works, sewerage system, and paving in Panama and Colon, the cost of which is to be reimbursed to the United States through the collection of water rates in those cities, and of the construction of water-works and sewerage systems, paving, grading, and road making in the Canal Zone. The total cost of the work done was $1,067,150.52. Work in Panama and Colon, as originally planned, is practically completed.

The total cost of municipal improvements in the Canal Zone has been, for water-works and sewers, $2,358,840.44, and for roads, etc., $1,174,778.26.

Building Construction.—During the year 505 new buildings were constructed; 1,147 American buildings repaired on account of deterioration, and additions or improvements made to 423 buildings; 1,178 old French buildings repaired on account of deterioration, and additions and improvements made to 275. The total expenditures for the year were $3,086,138.01, and the average number of men employed was 2,366. The average pay for skilled and unskilled labor per hour was, for gold men, $0.625, and for silver men $0.169. Of the total expenditures of this division for the year, $2,181,913.39 were spent in the construction of new buildings, the largest item of which was the construction of quarters for gold employees, which cost $982,771.86. The total cost of buildings constructed since American occupation to the end of the fiscal year has been $9,824,089.15, of which amount $421,882.64 have been spent for wire screening, with which all buildings are inclosed.

The total number of buildings constructed since American occupation is 1,462, and the total number on hand is 3,313.

At the cement block plant at Ancon 17,909 concrete blocks of various sizes were manufactured, at a cost of 12½ cts. per cu. ft. These blocks were used in the construction of vaults, fire walls, powder and detonator houses and chimneys.

Attention was given to reducing the cost of work in this division by (1) modifying and cheapening the cost of all type structures through the elimination of unnecessary features, (2) the adoption of more suitable and more satisfactory materials and cheaper methods of application, and (3) requiring higher efficiency in the performance of work through comparison of detailed cost statistics on work done in the different districts. Economic building work was stimulated by a comparison of the cost of buildings erected by contract. The principal type of buildings constructed by the commission are now costing from 7½ to 9½ cts. per cu. ft. for bachelor quarters and from 11 to 13 cts. for family quarters.

VIEW OF "CONTRACTOR'S HILL" LOOKING NORTH FROM GOLD HILL, MARCH, 1908.

COST KEEPING.

Beginning July 1, 1907, a system of engineering cost keeping was established, and monthly statements are prepared showing the cost of each principal piece of work. The cost is kept under two general heads, from division engineers' monthly reports and sundry general items. The first includes all expenditures pertaining to the work under the division engineers and furnishes a basis for comparing the relative cost of current work; the second embraces general expenditures, including general expenses of the commission, disbursing officer, examiner of accounts, labor, quarters and subsistence, material and supplies, and miscellaneous expenditures on the Isthmus, such as transportation, travel expenses, telegraph, and stationery. There are excepted from these expenditures, however, all charges of civil administration, sanitation, and municipal improvements, such as water-works, sewers, and roads within the limits of the zone. These expenditures are excluded because they are not useful in a comparative statement of the work proper, although necessary to the construction of the canal as a whole, and because they were not incorporated in the estimates of the minority members of the consulting board, whose plans are being executed.

The cost of plant is not included for the reason that all plant necessary to complete the canal has not yet

been acquired, so that an equitable distribution of this item cannot be made.

MATERIAL AND SUPPLIES.

During the fiscal year this division received material valued at $11,607,094.63 and disbursed material to a value of $11,685,158.33. Of the material issued, $182,894.56 cover old French material utilized or disposed of during the year, including scrap brass, copper, and cast iron used in the foundries at the Gorgona shops.

Some of the more important items of equipment received were: Thirty-eight steam shovels, 800 cars, 10 unloaders, 10 spreaders, 6 ballast plows, 9 cranes, 8 dredges, 5 tugboats, 12 steel barges, 2 air-compressor plants, 172 rock drills, 13 rock channelers, 508,000 lbs. track bolts, 1,684,000 lbs. track spikes, 119,150 lbs. angle bars, 470,000 tie plates, 481 15-ft. split switches, 628 frogs, 15 oil fuel tanks, 2 launches, 4 concrete mixers, 1 road roller, 3 motor cars, 1 material-handling plant, 1 15-ton rock crusher, 4 saddle-tank locomotives, 19,254½ tons of steel rails, 501,876 ties, 3 electric cranes, 18 hoisting engines, 38,985,521 ft. B. M. of lumber, 34,657 piles, 501,574 switch and cross ties, 246,000 brick, 8,852,000 lbs. dynamite, and 54,000 lbs. blasting powder.

LABOR, QUARTERS, AND SUBSISTENCE.

On the resignation of Mr. Jackson Smith, Maj. Carrol A. Devol, quartermaster, U. S. Army, was assigned to duty under the commission, and in the reorganization of the work the duties of this department are to be divided. To Major Devol will be assigned such of the duties of the old department as relate to labor and quarters, and there will also be added the duties of the present division of material and supplies, with the work of which his professional experience in connection with the quartermaster's Department of the Army has thoroughly familiarized him. The resulting department will be designated the "quartermaster's department."

The subsistence feature will be consolidated with the commissaries of the Panama Railroad and operated as the subsistence department of the commission, in charge of Maj. Eugene T. Wilson, Artillery Corps, U. S. Army.

Labor.—A net decrease in the skilled force was made during the year, yet there were almost as many new employees as in the preceding year, the number of men employed being 5,200 and 5,800, respectively, for the two years, indicating the shifting character of the force and showing that it is practically renewed every year. A radical change, however, has taken place in the source of supply. There were 1,828 men employed in the United States, as against 3,038 the year before, while the number employed on the Isthmus has increased from 2,780 to 3,382.

There are approximately 500 more Europeans and 1,000 more West Indians on the work than there were at the close of the previous fiscal year. To cover this increase and to fill vacancies caused by the departure of employees from the Isthmus 4,150 West Indians and 3,650 Europeans were imported. As the total excess of immigration over emigration was nearly 18,000, the labor problem may be considered as solved.

Subsistence.—At the close of the year 20 hotels were operated for Americans, 25 mess halls for Europeans, and 31 kitchens for West Indian laborers. A system of inspection was instituted during the year and an attempt made to improve the cleanliness of all classes of messes and to improve food supplies.

SANITATION.

The work of this department is two-fold; it is charged with general sanitary work of the Zone, as well as of the cities of Panama and Colon, which includes the collection of garbage, the removal of night soil, fumigation, disinfecting, cleaning of streets, draining and filling swamps, cutting of grass and removal of vegetation, minor repairs to screening, and ditching and tiling work for drainage; also the care of the sick and the maintenance of the hospitals.

General health conditions depend upon proper policing of quarters, securing and maintaining a wholesome water supply, and good sewerage, as well as such sanitary work as is outlined above. The present quartermaster's department is charged with the care of quarters and general policing; the engineering department is charged with water supply and sewerage, and the sanitation department maintains a tiling gang and ditching gang. The quartermaster's department must maintain gangs for policing and grass cutting in connection therewith in the same territory that the sanitation department has its force of laborers on sanitary work; either department is fully equipped to do the work of the other. Although the end in each case is the same—the general bettering of health conditions—the objects sought are to some extent different, in that the sanitary work is undertaken to reduce the breeding places of malarial and yellow-fever mosquitoes.

After careful consideration it was concluded that economy would result, friction be removed, and responsibility definitely fixed if, in addition to the work of policing and grass cutting in the vicinity of quarters, the quartermaster's department gangs were charged with the collection of garbage, the removal of night soil, and the cutting of grass and brush for the sanitation department, and if the tiling and drainage were carried on by the construction forces of the engineering department. With the approval and consent of the chief sanitary officer, the transfer of these duties will be made effective Sept. 1.

and in order that no impairment of sanitary conditions may result, the quartermaster's department is to perform such grass and brush cutting as may be designated by the various sanitary inspectors, and the sanitation engineers are to drain such areas as the chief sanitary officer may prescribe, in accordance with plans and upon data furnished by him.

If, with the shifting character of the [illegible]ation, the death and sick rate can be taken as a criterion for general health conditions, they have been considerably improved, for with an average of 43,057 [illegible] on the pay-rolls the death rate per thousand was 8.32, less than half that of the previous year. For the white force, taken at an average of 12,038, given by the pay-rolls, the rate was 15.34 per thousand, and with a force of blacks averaged at 30,999, the death rate was 19.48 per thousand, less than half that of the previous year. The large decrease in the death rate among the blacks is attributed to better sanitation, but, primarily, according to the statements of the doctors, to the better food, enabling them to offer greater resistance to disease.

At the beginning of the year 1,139 patients remained in the hospitals, and during the year 27,523 were admitted for treatment; of this number 929 died, 1,139 were still undergoing treatment at the close of the year, and the balance were discharged.

VIEW OF THE SITE FOR THE PEDRO MIGUEL LOCKS, LOOKING SOUTH. EXCAVATION DOWN TO GRADE, JUNE, 1908.

EXPENDITURES ON PANAMA CANAL, JULY, 1907-JUNE, 1908.

Total appropriations June 28, 1902 to May 27, 1908 ..... $120,964,468.58

EXPENDITURES.

Construction of canal.....	$57,357,346.47	
Buildings	8,549,668.90	
Panama water-works and sewers	1,342,857.00	
Colon water-works, sewers, and paving	894,275.17	
Settlements with Panama R. R. Co. and others in suspense	221,172.72	
Total, construction and engineering...		$68,365,320.26
Government of the Canal Zone	2,146,996.77	
Buildings	437,121.21	
Zone highways	1,174,778.26	
Total, civil government.....		3,758,896.24
Sanitation and hospitals....	7,171,315.46	
Buildings	837,299.04	
Total, sanitation and hospitals.....		$8,008,614.50
Loans to Panama R. R. Co.....		4,374,310.54
Purchase of Panama R. R. stock.....		157,118.24
Purchase of real estate outside of canal construction		59,433.36
Bal. due by laborers for their transportation		31,728.61
Services rendered and material sold individuals and companies		2,327,343.24
Total		$87,082,764.99
Less:		
Amount unpaid on pay-rolls. June, '08, rolls $1,487,780.88 Prior months.. 190,636.84	$1,678,417.72	
Value of material received from the New Panama Canal Co. and used in work or sold included in above and credited to purchase price of canal.....	831,348.72	
		2,509,766.44
Total expenditures		$84,572,998.55
Balance available July 1, 1908.....		$36,391,470.03

DISBURSING OFFICE.

During the year, disbursements on the pay-rolls of the commission amounted to $18,062,000, the average payment per month to employees on the gold roll being $125.80, and on the silver roll about $40 gold per month.

COMMISSARY.

Under the reorganization already effected, the commissary is operated by the subsistence officer of the commission, under the direction of the president of the Panama Railroad.

An average of 742 employees were carried on the rolls of this department, at an annual cost of $430,343.75.

WASHINGTON OFFICE.

Under the executive order of Aug. 15, 1907, the purchase of materials and supplies was placed under the supervision of the Chief of Engineers, U. S. Army, who was authorized to maintain a purchasing department in the office of the Isthmian Canal Commission, in Washington.

During the year 2,160 persons in the United States were tendered appointments on the Isthmus, covering 154 different positions, and 1,947 accepted; and 5,397 persons were provided with transportation from the United States to the Isthmus.

During the year the disbursing officer in the United States paid 10,956 claims, having a value of $13,728,288.51.

The purchase of all supplies and materials for commission use is under the supervision of the general purchasing officer in Washington (assigned for this duty from the Engineer Corps, U. S. Army), with assistant purchasing and shipping agents in New York, New Orleans, and San Francisco. A similar office at Tacoma, Wash., was discontinued on June 30, and the work taken over by the United States engineer office at Seattle and the Washington office. Circular invitations for bids are prepared from requisitions received from the Isthmus and distributed throughout the country; the practice of allowing bids to cover delivery of materials on the Isthmus has given all sections equal opportunity in submitting proposals.

Respectfully submitted.

Geo. W. Goethals,
Lieutenant-Colonel, Corps of Engineers, U. S. A.,
Chairman and Chief Engineer.

Culebra, Canal Zone, Aug. 25, 1908.

THE MEDAL TO BE GIVEN TO WORKMEN ON THE PANAMA CANAL.

The design for the medals to be presented to all workmen who serve for two or more years on the Panama Canal is shown by the accompanying illustration. The portrait of President Roosevelt, which appears on one face of the medal, was modeled in clay by Mr. Victor D. Brenner, of New York City, in July, 1908, at Oyster Bay. The original was made life size, and from this was made the paraffine reduction,

PANAMA CANAL MEDAL.
(Designed by Victor D. Brenner, New York City.)

7½ ins. in diameter, which is used as a model for the dies. The medals themselves will be 1⅛ ins. in diameter and are to be of bronze. The medal for two years' service will be suspended from a single bar, and for each additional year of service another bar will be added. In the open space on the rim of the medal below the shield of Panama will be engraved the name of the recipient and on the reverse side beneath the portrait of the President will be the number of the medal. The number of the medal presented to each workman will depend on the date of his entering the service.

TEST OF A NEW BUILDING MATERIAL.

A test of a new fireproof hollow block was made Nov. 12 by Prof. Ira H. Woolson at the new fire-testing station of Columbia University in Greenpoint, N. Y. The new material is known as "Sagax," and is manufactured by the Sagax Wood Co., Baltimore, Md. It is said to be made up of 60% of ground straw with magnesium cement as a binder and the blocks are 25% lighter than terra cotta tile of the same strength and size. The principal superiority of the new material lies in the fact that it is elastic, like wood, so that it is less readily broken than concrete or terra cotta blocks, and it may also be worked, painted or nailed to like wood, so that it is available for interior decorations and doors as well as for floors and partitions. In addition to hollow blocks for floors and partitions, Sagax is made in the form of paving blocks, railway ties and pipe covering. Solid slabs with match-joints are provided for building doors.

The test was made on a floor built of Sagax hollow blocks above a fireproof room 20 ft. long by 14 ft. wide. The construction was similar to the terra cotta hollow tile arch supported by I-beams. Specially shaped skew-back blocks protected the lower flanges of the beams. By means of a wood fire built on a grate 12 ft. below the floor, the temperature at a point 6 ins. below the test floor was maintained for four hours at a temperature of 1,700° F. During this time the floor was loaded with 150 lbs. per sq. ft. The maximum deflection in a 6-ft. span did not exceed ½-in. At the end of the four-hour period, the fire was extinguished and a ⅝-in. stream of water with a nozzle pressure of about 60 lbs. per sq. in. was turned against the under side of the floor. The lower web of the blocks broke off upon the application of the water. Pieces of this web appeared to be, in some cases, thoroughly charred, but the second web appeared to be sound and uninjured. On the following day, the floor as tested was subjected to a load of 600 lbs. per sq. ft. The deflection in a 6-ft. span was found to be 29/32-in. and upon removal of the load there was a partial recovery reducing the deflection to 9/32-in. In the case of the breaking off of the lower web, with Sagax flooring the repair work is much simplified by the fact that lath for replastering may be nailed directly to the exposed second web.

RICHARD C. MACLAURIN, PRESIDENT OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

The election of Professor Richard C. Maclaurin, of Columbia University, to the presidency of the Massachusetts Institute of Technology was noted in a recent issue. Dr. Henry S. Pritchett, former President of the Institute, formally resigned that office in January, 1906, and since that time Dr. Arthur A. Noyes, Director of the research laboratory of physical chemistry, has served as Acting-President pending the selection of a permanent executive.

Professor Maclaurin was born in Edinburgh, Scotland, in 1870. A few years of his boyhood were spent in New Zealand, but the greater part of his preliminary education was received in England. He entered the University of Cambridge in 1892 and graduated with the degree of B. A. in 1895, receiving the degree of M. A. the following year. He now holds from the same university the degree of Sc. D., conferred in 1898, and LL.D. conferred in 1904. In connection with work for his master's degree he gained the highest possible rank in the most advanced examination given at Cambridge in mathematics, and received the Smith prize for his thesis on the same subject. After his graduation, he was elected a fellow of St. John's College, Cambridge.

During 1896 and '97 Professor Maclaurin devoted several months to the study of educational institutions in the United States and Canada, giving most of his attention to McGill University in Montreal, the University of Toronto and Leland Stanford University. After concluding these investigations, he reentered the University of Cambridge and took up the study of law, receiving the McMahon law studentship. For his thesis on "The Title to Realty" he was awarded the Yorke prize, and this thesis was afterward published in English and French, attracting the comment of many prominent authorities. During this period, on a leave of absence, he spent six months in study at a German university.

In 1898, he became Professor of Mathematics at the University of New Zealand, and later became a trustee of the same institution. In 1903, he was made Dean of the faculty of law and remained in New Zealand in this capacity until his appointment to the chair of mathematical physics at Columbia University in the fall of 1907. At a meeting of the executive committee of the corporation of the Massachusetts Institute of Technology held Nov. 11, 1908, Professor Maclaurin was elected to the presidency, and on the following day was announced his acceptance of that position.

Professor Maclaurin is the author of a treatise on physical optics, of which the first volume was published in February of the present year. He has also contributed a number of papers to scientific magazines, and one of these, on "Higher Technical Education in the United States," which appeared in a recent issue of the "Revue Scientifique," is of special interest in connection with his new position for the reason that, in it, the Massachusetts Institute of Technology is described as the typical American technical school.

MINERAL PRODUCTS OF THE UNITED STATES.—The value of the mineral products of the United States in 1907 reached a total of $2,069,289,196, surpassing the value of the same products in 1906 by $165,282,162, or 8.68%, that of 1905 by 27.33%, and of 1904 by 58.81%. The minerals whose output in 1907 was valued at more than $5,000,000 are listed in the accompanying table:

Coal	$614,798,898
Iron	529,958,000
Copper	173,799,300
Clay products	158,842,389
Petroleum	120,106,749
Gold	90,455,700
Stone	71,105,805
Cement	55,903,851
Natural gas	52,866,835
Lead	38,707,576
Silver	37,299,700
Zinc	26,401,910
Sand and gravel, etc.	13,242,002
Lime	12,640,512
Phosphate rock	10,653,558
Salt	7,439,551
Mineral waters	7,331,503
Zinc white	6,490,660
Slate	6,019,220
Sulphur	5,142,850

Both metallic and nonmetallic products contributed to the gain. Coal and iron are credited with approximately 55% of the total for the country, and copper, clay products, and petroleum furnish about 22%, the five contributing about 77% of the whole.

Pennsylvania has no close rival for first place among the states. The other leading states in order of production value with chief product are: Ohio, Illinois, West Virginia (coal, petroleum, natural gas), Colorado (gold and coal), Michigan (copper), New York (pig iron), Montana (copper), Arizona (copper), California (gold and petroleum).—From advance chapter of Bulletin of U. S. Geological Survey on "Mineral Resources of the United States, 1907."

Richard C. Maclaurin

(From photo by Gessford.)

THE CATARACT DAM, SYDNEY NEW SOUTH WALES.

In our issue of Dec. 6, 1906, we described and illustrated the Cataract Dam, then under construction to increase the stored water supply of Sydney, N. S. W. The author of that article, Mr. L. A. B. Wade,* M. Inst. C. E., has kindly sent us some additional views of the dam, which we reproduce herewith. Figs. 1 and 2 show the dam completed, except for the valve house. Fig. 3 is from a photograph taken at an earlier date, to show the general character of the masonry which composes the bulk of the structure.

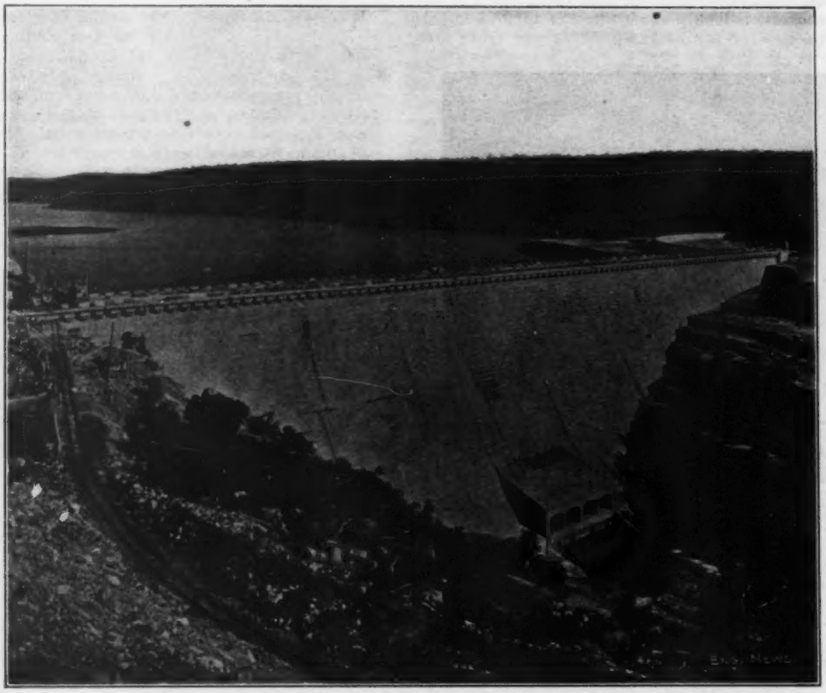


FIG. 1. THE CATARACT DAM FOR THE WATER SUPPLY OF SYDNEY, N. S. W.

For the convenience of our readers we repeat a portion of the description of the dam, as given by Mr. Wade in our issue of Dec. 6, 1906:

The main bulk of the dam consists of cyclopean rubble masonry formed of blocks of sandstone weighing from 2 to 4½ long tons set in cement mortar and packed in with concrete, in which basaltic stone is used. The sandstone blocks are roughly hewn to rectangular form, and the proportion of blocks to concrete and mortar is approximately as 65 to 35. The up-stream face of the dam consists of basaltic concrete blocks, 5 × 2½ × 2 ft., molded, set in cement and backed by an average of 3 ft. of basaltic concrete, while the down-stream face is formed of 6 ft. of basaltic concrete molded in place.

The foundations of the dam have been carried to a depth of 40 ft. below the bed of the river in solid sandstone rock. Two 48-in. pipes, with valves, communicating with outlet wells and sluice valves in the up-stream face of the work, will form the permanent outlet; but two additional 48-in. pipes (making four in all) are provided to pass the river flow during construction.

The valve house on the down-stream side of the dam is roofed with reinforced concrete to provide against damage by water topping the work during construction, and the contracts provide that the valves shall be left open till the lowest portion of the wall reaches a level of approximately 80 ft. above the river bed.

. . . . . .

The writer is responsible for the design and carrying out of the structure, assisted by Mr. E. M. de Burgh, M. Inst. C. E., of the same department, who has principal charge of the work. Mr. J. Symonds is Resident Engineer. Messrs. Lane & Peters are the contractors.

From the annual report of Mr. Wade for the year ending June 30, 1907, which has just come to hand, it is stated that night work had been "carried on as heretofore to ensure completion on contract time," April 9, 1907, and that on June 30 the work had been completed, except for the parapets and valve house. The dimensions and quantities in the table on this page are reprinted from the report just named.

The cost of the work was approximately $1,600,000, which was some $50,000 less than the estimate. The reservoir at full supply level will cover about 2,456 acres.

*Chief Engineer for Rivers, Water Supply and Drainage, Department of Public Works, Sydney, N. S. W.

PRINCIPAL DIMENSIONS.

Length of dam	811	ft.
Height above river bed	157	"
Depth below river bed	35	"
Total height from base to top (maximum)	192	"
Top width	16½	"
Bottom width	138	"
Maximum depth of stored water	150	"
Total storage capacity	21,411,500,000 gals.*	
Area covered by water (approximately)	2,400 acres	

MATERIAL IN DAM AS COMPLETED.

Hearting masonry	111,455	cu. yds.
Rubble masonry	1,975	" "
Concrete	23,846	" "
Facing blocks	8,966	" "
	146,242	
Total cement used	19,000	tons.
Quantity of excavations in connection with works, formations, by-wash, etc.	215,100	cu. yds.
Iron work in pipes, valves, etc.	319	tons.

*Nearly 26,000,000,000 U. S. gals.

THE WORK OF BOARDS OF HEALTH.*

By GEORGE A. SOPER,† M. Am. Soc. C. E.

The spirit of the laws by which many of public health are administered rests upon the theory which underlies all forms of government; that the state has the power to compel the ignorant, the selfish, the careless and the vicious to so regulate their lives and property that they shall not be a source of danger to others.

Extraordinary powers have from early times been vested in the authorities charged with administering sanitary laws. The highest courts have declared that the administration of public health laws is fundamentally important and entitled to the support of the police power of the state. Public health authorities are, in effect, police officers charged with a special jurisdiction over the conditions which cause, aggravate, or predispose to disease. In the exercise of these remarkable powers health authorities may restrain persons from contact with others, may enter upon and even destroy private property, and may exercise supervisory jurisdiction over trades and occupations.

Many years ago the almost autocratic power enjoyed by health authorities was much more necessary than it is at present, for the highly contagious diseases have, through the operation of health laws, better personal and household hygiene and municipal sanitary works been relegated to a comparatively unimportant place as a cause of death. Epidemics of high mortality and vast extent rarely take place in civilized countries to-day, and the need of a prompt, decisive exercise of great authority in this direction is consequently less often necessary than formerly.

At the same time a new class of duties is growing upon health authorities. Some of these duties are plainly within the proper functions of health boards, while others appear to be less so. Among the obviously proper duties referred to are vaccination, the manufacture and distribution of anti-toxin, the control of methods of sewage disposal, the sanitary management of milk and water supplies. Of less obvious appropriateness is the regulation by boards of health of such matters as the discharge of excessive quantities of smoke into the atmosphere of cities, the regulation of street noises, the hygienic care of the food, clothing, exercises and amusements of school children. It is possible that these matters should be made the subject of regulation in the public interest, but should the board of health be the instrument chosen to regulate them?

Obviously some limit should be placed upon the exercise of the power possessed by boards of health when questions not strictly germane to the sanitary welfare of the public are concerned. If no such limit is placed it is difficult to understand where the activities of boards of health are to cease. Almost every act and occupation and nearly every feature of city life may be construed as having some bearing upon public health and welfare. Before a board of health sets out upon a campaign of more aesthetic than sanitary value it

*Extract from a paper read before a Joint meeting of the National Municipal League and the American Civic Association of Pittsburg, Pa., Nov. 16, 1908.

†Consulting Engineer, 17 Battery Place, New York City.

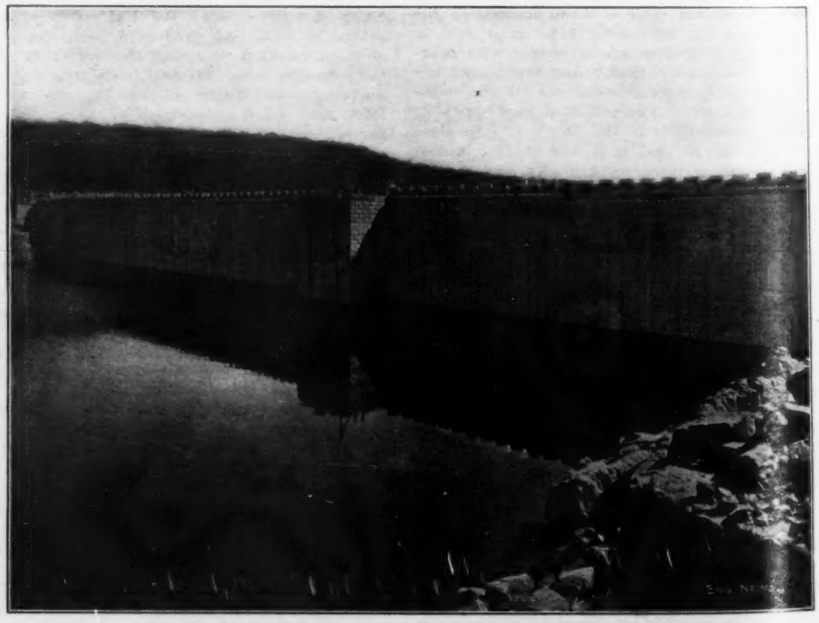


FIG. 2. VIEW OF CATARACT DAM, SYDNEY WATER SUPPLY, FROM ABOVE.

should be certain that all its simple and essential duties are being efficiently discharged. There is often much inconsistency in public health work.

There is something incongruous about a board of health conducting a crusade against smoke and noise and at the same time allowing the streets to be filthy with dirt and dust and offensive with accumulations of fermenting garbage. Again, a great deal of the attention of health boards is occupied with alleged nuisances. Citizens complain of their neighbors' hen houses, of

FIG. 3. CHARACTER OF THE BULK OF THE MASONRY OF THE CATARACT DAM, SYDNEY WATER SUPPLY.

their landlords' plumbing and other offensive conditions, and it is the duty of the board of health to investigate and determine whether a nuisance exists and, if so, how it should be corrected. The history of every city is a record of more and more strict regulations to minimize the unpleasant as well as the unsanitary conditions of municipal life.

The authority exercised by public health boards is derivable from the state. In the United States the management of the internal affairs of each separate state is left, for the most part, to the state concerned. Municipal charters are obtained from the state governments and in these charters the power to regulate conditions affecting public health are specifically granted. Cities and towns thus owe responsibility to the state government and are answerable to them to a greater or less extent, depending upon local circumstances. In Massachusetts local boards of health are comparatively independent of the state authority, while in New York the state department of health is a central body to which the local boards of health are closely tributary.

It is first the duty of all boards to collect vital statistics, to assemble them in tabular form, and to interpret these data so as to show the state of the public health.

The second main branch of public health work is the suppression of communicable diseases. Suppressive measures include the establishment of quarantine, the isolation of patients, disinfection, vaccination and the management of epidemics. Contrary to the custom of twenty years ago, all the best work in these directions to-day is based upon a scientific knowledge of what we may call the natural history of disease.

The third main branch of public health work is the abatement of nuisances. The practical work of suppressing unsanitary conditions is done by health authorities by resource to special statutes and local regulations made by the authorities themselves and termed "sanitary ordinances" or "sanitary codes." Offenders against these laws and regulations are brought before proper magistrates and fined. A board of health thus exercises the unique function of both making and enforcing the law.

It is often extremely difficult to determine what does and does not constitute a nuisance. For practical purposes it may be considered that anything which is detrimental to health or which threatens danger to persons or property may be considered and dealt with as a nuisance.

Interesting work for the suppression of disease lies in educating the public, the medical profession and the health authorities as to the causes of and means of preventing the transmission of disease germs. This is one of the newest and most successful branches of public health work which has been undertaken for many years. It is based on the fact that people are not careless in sanitary matters because of a wilful or vicious design against the public welfare; they err through ignorance. By educating the less fortunate concerning the ways in which diseases are transmitted and showing how they can be prevented, substantial benefit results.

This educational work is carried on through the daily papers, the medical papers, special bulletins and magazines, by lectures, by congresses, and, to some extent, by schools. Sanitary societies and public health associations deserve special credit for good work in arousing the public to the need of better public health work.

In the management of communicable diseases the principles of isolation, disinfection, vaccination, have been referred to. It remains to mention the help that may be afforded by the establishment of laboratories for the diagnosis of suspected cases of communicable diseases. Laboratories where examinations may be made of sputum, blood, urine, stools and other pathological specimens, are one of the newest developments in public health work, but they have been in operation sufficiently long to make them seem indispensable. By their means early and obscure cases of tuberculosis, typhoid fever, diphtheria and other too common preventable diseases may be discovered, and with a precision and promptness generally impossible in private medical practice. Along with pathological work of municipal public health laboratories facilities are often provided for the analysis of water, milk, food and drugs. Any citizen may send specimens to these laboratories for examination, and is entitled to a report without charge.

Every board of health should have the benefit of laboratory assistance of this kind. Municipal boards in large cities can afford to maintain them, but for the small city and village other provision must be made. Here the state can render valuable assistance and maintain laboratories for the benefit of municipalities which cannot have them.

To be effective, health work must be cooperative. Statistics must be promptly and accurately collected by the ultimate units of sanitary authority, municipal health boards, and transmitted to boards having jurisdiction over larger territory. Whether or not the largest unit of health control should be the state or the nation is a question which this paper need not discuss. It is to be remembered in this connection, however, that state boundaries are only imaginary lines and that some kind of understanding is indispensable between neighboring states for some forms of sanitary control, such, for example, as the purity of water supplies, the management of epidemics and the regulation of milk and other food products. Likewise the management of quarantine, a subject of importance to large portions of the population of the nation, should not be left to the regulation of any particular locality, but should be managed in accordance with laws which are general for the common welfare.

First and foremost among the defects and needs of public health administration must be placed the want of adequate knowledge of the principles and practices of public health work on the part of officials having jurisdiction. It is a deplorable fact that special professional qualifications are not as a rule required of health officers in the United States.

If there is any department of municipal government which should be taken out of politics and put upon a high plane of professional efficiency, it is public health work. Generally, in the United States, appointment upon a health board means a thankless and gratuitous service performed for the sake of a small honor which is supposed to go with it. Where a salary is connected with the position the office is too often a reward of political rather than professional merit.

[The following discussion of Mr. Soper's paper was contributed by Mr. M. N. Baker, President of the Board of Health of Montclair, N. J.—Ed.]

Of the many questions which Mr. Soper's paper raises for discussion two major ones present themselves: (1) Just what is the proper field of health board work and (2) how should that field be divided between the city or town, the state and the nation.

The first of these questions Dr. Soper has perhaps answered as fully as the present occasion demands. The work of boards of health should be essentially health-protective. This statement may seem to be so obvious as to be ridiculous, but the author has ably shown that much health board work in the past and no little such work at present has no direct relation to health.

As to the proper division of the field between the locality, the state and the nation, it is obvious that upon local boards of health must and should fall nearly all the direct labor of preventing the spread of disease in specific localities and of doing what can be done at present to promote the general health of the public. In the daily routine of health-protective work in the community the state should intervene only in some dire emergency, when an epidemic has got beyond the control of a local board—a state of affairs which will rarely if ever arise where an efficient local board of health exists.

The chief functions of state boards of health, as regards specific localities, should be of an advisory and regulative or supervisory character. Questions arising infrequently in any given community, and particularly in the smaller towns, may readily be answered by the state board. The state board should also establish standards of practice and efficiency to which it should have the power to hold the local boards.

A somewhat different but very important function of state boards of health is control of the design and operation of public works, the improper design and operation of which would menace the health and life of a whole community or perhaps of many cities and towns. Public water supplies and sewerage systems fall in this class. Even those who would object to state interference with the water supply of a single community would agree to the propriety and necessity of central control where the sewage of one city might infect the water supply of another city and give rise to a typhoid epidemic there, as has so frequently happened in this country.

It should also be remembered that in these days of free movement of population the water supply of any given community may be a menace to the lives of citizens of many other places, as they come and go in their travels. Thus the water supply of Pittsburg, now purified by a modern filtration plant, was for many years a most efficient agent for the spread of typhoid fever over the whole country. The time may yet come when such a condition will be considered a fit subject for national interference.

Analogous in some respects to water supplies and sewage disposal, and like them fit subjects for state supervision, is the public milk supply. This is particularly true of dairying sections from which milk is shipped to many different communities, or perhaps to several states.

We come next to the place of the national government in health-protective work.

Under our scheme of government, where the nation has only such powers as were delegated to it by the several states long before health board work was thought of, what remains for the general government to do after local and state boards of health have exercised their function?

If our general government stood in the same relation to the several states as do the states themselves to the communities composing them the answer would be ob-

vious. And, too, there would be plenty of work for a national bureau of health, for but a few of our states have yet made any approach to efficient public health administration. As the case now stands, however, the chief health-protective function of the national government seems to be of an interstate regulative character and also, and in no small measure, educational. The protection of interstate waters from pollution, sanitary supervision of foods and drinks passing from one state to another, quarantine and like matters fall properly within the scope of the national government. Interstate milk supplies in particular, as has been suggested already, afford ample scope for a national health bureau.

The possible educational work of the general government (and the same is true of the state governments) includes as a partial basis a considerable amount of experimentation which is beyond the powers of local boards of health and which if done by a central body or bodies would save much useless duplication.

If we turn to the U. S. Department of Agriculture we can find plenty of examples of the educational and experimental work that might be done by a national health bureau. The numerous studies and pamphlets on the diseases of plants and animals made by the U. S. Department of Agriculture could easily and profitably be duplicated with proper modifications, in the interests of human instead of plant and animal life. Latterly, the reorganized U. S. Public-Health and Marine Hospital Service has done considerable valuable work along this line.

It is an open question how far a national health bureau should go in making strictly local investigations and in helping suppress local outbreaks of disease. The recent highly efficient work of the U. S. Public-Health and Marine Hospital Service on yellow fever at New Orleans and elsewhere was of course justified because of the interstate relations involved. The notable investigation of typhoid fever at Washington, D. C., by the same government agency, was also obviously justifiable, since it dealt with matters under the sole control of the national government.

The Washington typhoid study suggests that other investigations relating to the public health in the District of Columbia might be profitably conducted by the general government.

Although not health board work, why could not our general government make up some of the deficiencies in health-educational facilities mentioned by Dr. Soper, and so obvious to every student of public health questions, by providing or aiding schools of public health? For years past the United States has made large annual appropriations to state agricultural schools. Why not do the same for state health schools? Why not have state health experiment stations, also, as well as state agricultural experiment stations, the health schools and health experiment stations cooperating and a national bureau of health serving as a clearing house for the information thus gained, as well as a distributor of vital statistics and other data relating to the public health of each and all of the states of the Union?

Finally, is it not apparent that this whole question of the work of boards of health, and of the relations between national, state and local health-protective work, demands as careful study by the National Municipal League and the American Civic Association as was put by the former organization upon the Municipal Program and as has been and is being put by the League on Municipal Accounts and Reports?

TESTS OF REINFORCED CONCRETE COLUMNS.

FOR DEPARTMENT OF BUILDINGS, MINNEAPOLIS, MINN., NOVEMBER 11, 1907.

All columns 9 ins. square. Reinforced columns 9 ft. 6 ins. long; plain columns 5 ft. long. Material, 1 : 2 : 3½ concrete (limestone and bank sand); age at test various, as noted. Columns tested vertically, with cast-iron end caps bedded over each end in cement setting under load 24 hours.

Name.	Hoops or Bands.	Longitudinal Rods.	Age at test, days.	Ultimate load—Lbs.	Lbs. per sq. in.	Manner of failure.	Deflection at center.	Compression in 8 ft. at failure.
Plain	None	None	98	162,000 (1st crack 160,000)	2,000	Failed at center	Not reported	0.0544-in. [in 42 ins.]
Plain	None	"	99	165,000 (1st crack 160,000)	2,040	Failed 28 ins. from top	Not reported	0.0610-in. [in 42 ins.]
SPIRAL WIRE HOOPED.—American Wire Fence Co.'s spiral No. 7 high carbon wire, 7 ins. inside diameter, 2 ins. pitch. Longitudinal rods uniformly spaced around inside of spiral.								
Am. 2 (1st)	No. 7 wire 2 in. pitch	None	53	176,000	2,175	Bending 24 ins. from top.	Not reported	0.0113-in. (?)
Am. 2 (2d)	"	"	83	125,000	1,540	Deflected and broke off 13½" from bottom	Not reliable	Not reliable
Am. 1	"	4 ½-in. round rods	79	226,000	2,790	Spiral burst 19" from top	¼-in.	0.1905-in.
CIRCULAR FLAT-BAR BANDS.—Bands of 1¼ x ⅛-in. strip, bent to circle. 7 ins. inside diameter, joined with lap, two ½-in. rivets. Longitudinal rods uniformly spaced around inside of bands.								
A 1	30 bands (4-in. spac'g)	4 ½-in. round rods	63	156,510	1,930	Band at center broke through rivet hole	None	Not measured
A	"	10 ½-in. round rods	61	130,000	1,610	Bending at center (bad batch of concrete at this point)	Not reported	Not reported
B 1	20 bands (6-in. spac'g)	4 ½-in. round rods	84	166,000	2,050	Rods buckled between bands 10" from bottom	$\frac{3}{16}$-in.	0.1120-in.
B	"	10 ½-in. round rods	85	226,000	2,790	Rods buckled between bands at center	½-in.	0.1512-in.
C (1st)	15 bands (8-in. spac'g)	10 ½-in. round rods	52	135,000	1,670	8" from bottom. Broken end then cut off and column retested	None	Not measured
Retest	"	"	54	142,000	1,750	Failed as before	None	Not measured
C (2d)	"	"	133	230,000	2,840	Rods buckled between bands at center	None	0.1045-in.
WIRE BANDS, SQUARE.—Eight longitudinal rods, four being at the corners of a 7-in. square, the other four at the middle of the sides. Bands of ½-in. round, one turn around the four corner rods, one turn around the middle rods, both ends of each turn being bent radially inward.								
E (1st)	14 pairs (9-in. spac'g)	8 ½-in. round rods	95	236,000	2,920	Rods buckled between bands and bands pulled out 16" from top	None	0.1045-in.
E (2d)	"	"	158	184,000	2,250	Same, 18" from bottom	None	0.0807-in.
D (1st)	20 pairs (6-in. spac'g)	"	98	228,000	2,870	Rods buckled between bands 18" from bottom	$\frac{1}{16}$-in.	0.1302-in.
D (2d)	"	"	153	241,000	2,975	Same, 24" from bottom	None	0.1045-in.
F (1st)	39 pairs (3-in. spac'g)	"	64	228,450	2,825	Rods buckled between bands and bands pulled out 16" from bottom	None	Not reported
F (2d)	"	"	91	230,900	2,840	Same, 14" from bottom	$\frac{1}{32}$-in.	0.1685-in.
WIRE BANDS, CIRCULAR.—Longitudinal rods in polygonal arrangement, 7 ins. diameter. Hoops of ½-in. round rod wrapped one turn about periphery and ends turned radially inward on opposite side of same rod. Successive hoops end at different rods.								
L 1	39 bands (3-in. spac'g)	8 ½-in. round rods	66	200,600	2,480	Rods buckled between bands 36" from top	None	Not measured
L	"	10 ½-in. round rods	68	205,160	2,530	Rods buckled between bands and ends of bands pulled out 14" from bottom	None	Not measured

NOTE.—All longitudinal rods full length of column. All reinforcing metal mild steel, except spirals. In all tests of reinforced columns, at loads from ⅔ the ultimate upward, the concrete outside of the hooping was so shattered or fallen off that the ultimate load was carried by the hooped area. The loads per square inch in the table, however, are computed for the full original area.

TESTS OF REINFORCED-CONCRETE COLUMNS AT MINNEAPOLIS, MINN.

A series of tests of reinforced-concrete columns was made last year by the Department of Buildings of the city of Minneapolis, Minn. The tests included 17 reinforced columns, all of which were 9 ins. square and 9 ft. 6 ins. long. Two plain concrete columns were also tested, to give a basis for comparison; these were 9 ins. square, the same as the others, but only 5 ft. long. The results of the tests are rather disappointing, in that they are sufficiently erratic to make impossible any clear-cut conclusions. But, of course, this very fact is of moment, since it proves that single tests, or a small number of tests, are of no value for drawing conclusions as to comparative efficiencies of different methods of construction.

The test columns were made of 1:2:3½ concrete, using bank sand and blue limestone, one-half of the stone being of ½-in. size and one-half of pea size. The cement, of the "Universal" brand, showed the following tensile results, six samples being tested at each age: 7 days, 370 to 485, av. 410; 28 days, 495 to 680, av. 572; 60 days 570 to 610, av. 593. Sand-mortar tests, of 1:3 mixture with standard sand, gave 130 to 178, av. 150, at 7 days; at 28 days 155 to 208, av. 173; and at 60 days 205 to 210, av. 208 lbs. per sq. in. Nine-inch cubes tested in compression at 98 days showed first crack at 2,225 lbs. per sq. in. and failure at 2,261 lbs. per sq. in. In comparison it will be noted that the two plain columns tested showed a crushing strength of 2,000 lbs. per sq. in. at 98 days.

For testing, all columns were capped with cast-iron end caps 9¼ ins. square inside and 3 ins. deep, the outer end-face planed. Neat cement was put into the caps to a depth of 1-in. before putting them on the column ends, and then a load of 100 lbs. per sq. in. was applied for 24 hours.

We have arranged the results of the tests in the table printed below. It will be seen that there is no recognizable relation between ultimate strength and the type or amount of reinforcement. The reinforced columns averaged about 25% stronger than the plain columns, though five of the 17 failed at lower loads than the plain columns.

The tests were made under the direction of Mr. James G. Houghton, Inspector of Buildings, and Mr. Wm. P. Cowles, Department Engineer, of Minneapolis, Minn. We are indebted to them for a copy of the results.

TRAFFIC ACROSS THE EAST RIVER has been measured by a count arranged by the Public Service Commission of New York City on Nov. 5. The total travel amounted to 816,289 persons, or substantially 400,000 in each direction. The detail figures are as follows:

	To New York.	From New York.	Totals.
Ferries	83,311	81,431	164,742
Williamsburgh Bridge	89,293	92,731	182,024
Brooklyn Bridge	161,534	148,281	309,815
Subway	79,438	80,270	159,708
Totals	413,576	402,713	816,289

While the figures are doubtless not absolutely accurate, as the rush of passengers across the bridges during the busy hours of the day is too great to make accurate counting possible, they give a fair idea of the enormous travel between the two principal boroughs of New York.

CLEANING LEAD-FURNACE CRUCIBLES from metallic accretions is effected at the smelting plant of the St. Joseph Lead Co. at Herculaneum, Mo., by means of dynamite. In these furnaces the accretions of copper, iron, etc., entirely shut off in time the flow of lead through the lead well. The common method of mechanically removing these accretions is laborious and usually requires the shutting down of the furnace. In the method devised by Mr. J. O. Bardill, Mechanical Engineer of the plant mentioned, a bomb constructed of standard pipe fittings—one 1-in. nipple 4 ins. long, two couplings and two plugs—is lined with sheet asbestos with shredded asbestos at each end, charged with about one-seventh of a stick of 60% dynamite, attached to one end of a long iron rod and introduced into the crucible through the lead well. The insertion is made while the furnace is in operation and the time elapsing before explosion is given is from 15 to 25 seconds. In a description of this method published in "The Engineering and Mining Journal" for Oct. 17, 1908, it is stated that one bomb is usually sufficient to reestablish a perfect circulation and that the damage to the crucible itself is very slight.

SPECIAL STRUCTURAL STEEL WORK IN THE LA SALLE HOTEL, CHICAGO.

The La Salle Hotel is a large and imposing structure which is now under construction in Chicago, and which includes some special features in the design of its steel framing. It will be a notable addition to the hotels of Chicago, which city has very second-rate hotel accommodation for a place of its size and importance. The work on the new hotel is well advanced, and the building will be ready for occupation next summer.

The La Salle Hotel occupies a site about 160 × 175 ft. at the northwest corner of La Salle and Madison Sts. It is 21 stories high, with a height of about 260 ft. from the curb line to the roof. A basement floor and a sub-basement extend over practically the entire area. The boiler room, which is a part of the sub-basement, is at an increased depth, its floor being about 32 ft. below the curb. The exterior finish is of stone to the level of the fourth floor. Above that it is of brick with terra-cotta trimmings. The roof and floors are of hollow tile block construction. The main portion of the roof is flat, but on the two street sides it has a curved mansard face beginning at the 19th floor. The mansard roof (which covers the main banquet hall) has a framing of small beams and tee bars to carry the ornamental roofing tile.

The sub-basement will contain the boilers, engines, pumps, electrical plant, and other mechanical equipment. A steel smokestack 8 ft. 6 ins. diameter extends from the basement to above the roof. Above the third floor level it is surrounded by a steel vent shaft 12 ft. square.

The foundations consist of 89 cylindrical concrete piers (locally termed "caissons") from 5 ft. to 10 ft. 6 ins. diameter. These are carried through the Chicago clay to bed rock, at an average depth of 106 ft. below the curb level. Open pits or wells were excavated by hand, being lined with wooden staves and steel interior ring braces, in the manner generally employed in sinking these deep foundations in Chicago. As the piers extend to rock they are not enlarged at the base, as is done when piers are carried down only to hard-pan. The permissible load at the base of the piers is taken at 28.8 tons per sq. ft. In order to brace the piers laterally, they are all connected at the top by concrete beams or struts. These are below the sub-basement floor, and as a rule they are 30 ins. wide and 42 ins. deep. The interior design of the building necessitated an unsymmetrical arrangement of the foundation piers and the columns.

The concrete walls of the basements are in general of the usual battered section and have no reinforcement. They were built in trenches before the general excavation was made. On the north side, however, the deep walls of the space excavated for the sub-basement are of concrete 45 ins. thick, reinforced by vertical 15-in. I-beams spaced about 3 ft. apart. The lateral thrust of the earth against the walls is taken up by the solid concrete floors of the basements, quite independent of the steel framing. For this reason, the walls had to be securely braced by shoring until the concrete floors had set. The steel framing over the sub-basement consists of 24-in. plate girders, and 20-in. and 24-in. I-beams; some of the latter are reinforced by top and bottom cover plates. The concrete floor slab is 12 ins. thick, and is reinforced with plain steel rods. The longest spans are about 15 ft. 6 ins. The top of the slab is a few inches above the top flanges of the plate girders of the floor system, and its lower side is extended to enclose the girders.

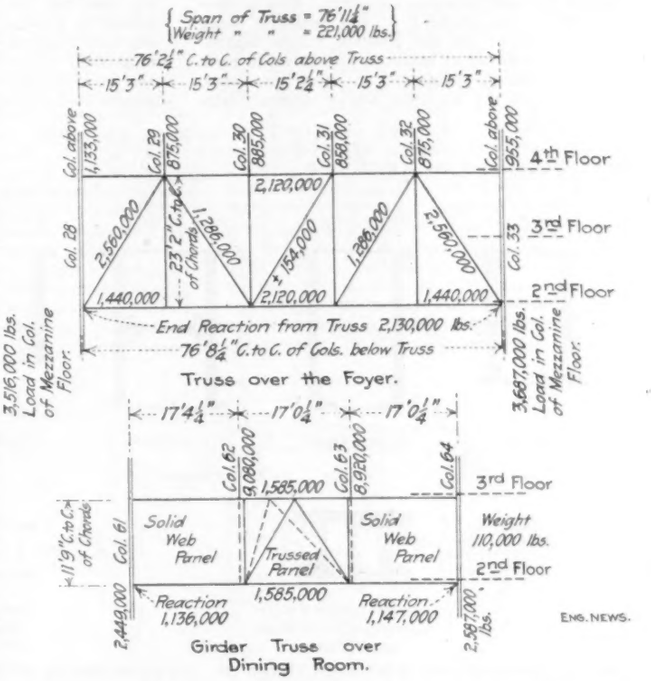


FIG. 1. DIAGRAMS OF TRUSSES CARRYING INTERMEDIATE COLUMNS ABOVE OPEN SPACES IN THE LA SALLE HOTEL, CHICAGO.

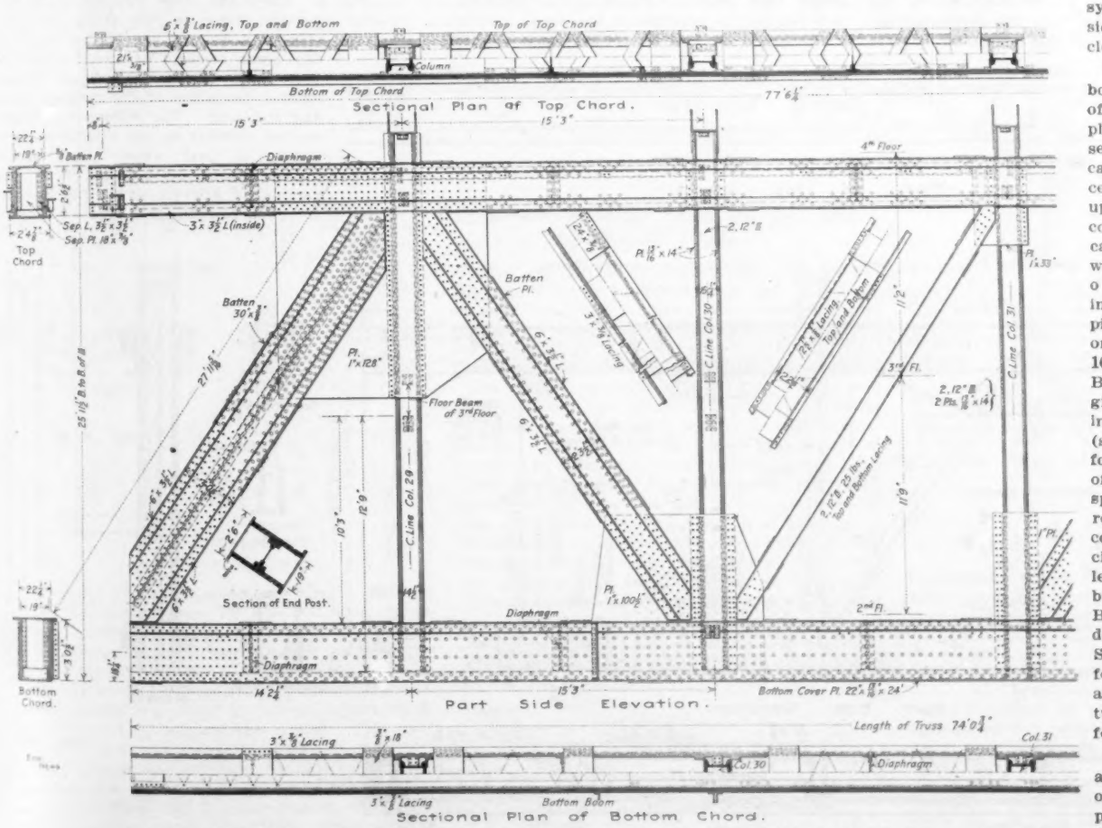


FIG. 2. DETAILS OF TRUSS SUPPORTING INTERMEDIATE COLUMNS ABOVE THE FOYER.

The columns are of box section, each built up of channels and cover plates. Special built-up sections are used in some cases where trusses concentrate heavy loads upon the columns. Each column is seated on a cast-iron base or shoe, which rests upon a group of I-beams embedded in the top of the concrete pier. The columns are ordinarily spaced from 16 ft. to 24 ft. apart. Between them are plate girders and heavy 12-in. to 20-in. I-beams (sometimes in pairs) forming the main panels of the floor framing. No special wind bracing is required, the standard connections being sufficient in view of the length of the sides of the building. The material is Bessemer steel, made under the "Manufacturers' Standard" specifications for medium steel, and about 7,200 tons of structural steel are required for the building.

The main floor panels are subdivided by lines of I-beams forming the panels for the hollow tile floor arches. These I-beams are usually 10 ins. deep, but their size varies with special requirements. They are connected by ¾-in. tie-rods in the usual way. In three of the panels, these I-beams are given a special arrangement (which is not symmetrical with that of adjacent panels) in order to permit of future removal to form

spaces for stairways and elevators. This is done to meet a requirement of the property lease, which provides for the possible future separation of one corner of the structure so as to form an independent building. In such an event, this part of the building would require stairways and elevators of its own, which are not needed under the present occupancy of the structure as a single building.

The general structural design of the building is as described above, but there are some important features which are necessitated by the architectural design and are of particular interest. In a building of this character certain large rooms and open spaces must be provided, in which no columns are admissible, and the structural designer has to provide for carrying the load of the superstructure across these spaces. Four special cases of this kind are included in the La Salle Hotel.

(1) The hall or foyer on the first floor is spanned by a truss two stories high, which supports four columns of the upper floors. (2) The dining-room on the first floor is spanned by three truss-girders one-story high; each of these supports two columns of the upper floors. (3) The large banqueting hall on the 19th floor is spanned by arch trusses carrying the roof. (4) The small banqueting hall on the 19th floor is two stories high, and the 21st floor is suspended above it by hangers attached to four heavy roof trusses. These special features we will proceed to describe in the order mentioned.

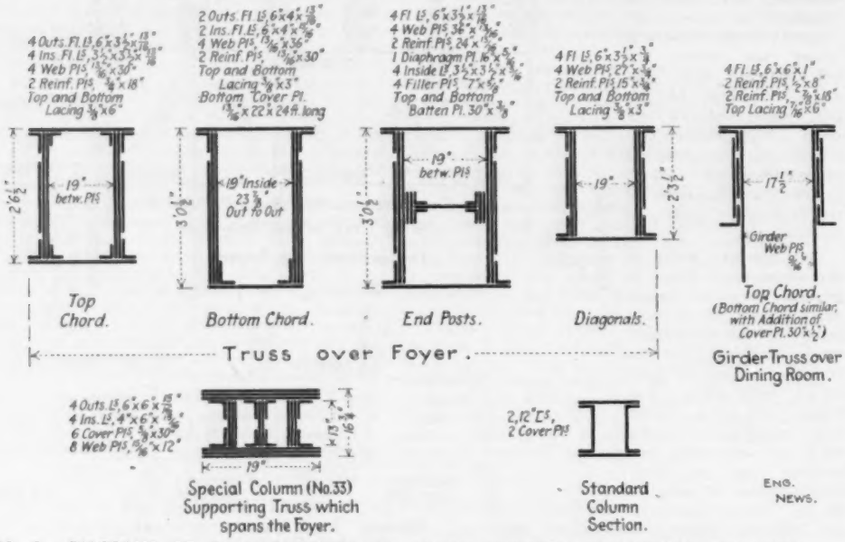


FIG. 3. DIAGRAMS OF CROSS-SECTIONS OF TRUSS MEMBERS AND SPECIAL COLUMNS.

TWO-STORY TRUSS OVER THE FOYER.—On the first floor is the main hotel office or foyer about 76 × 90 ft., which is kept entirely free of columns. One portion of the ceiling of the office forms the bottom of a central light court, and this part is roofed with an ornamental glass skylight. Four of the columns of the upper floors (in the side wall of the court [illegible] would pass through the foyer if permitted to [illegible]h directly to their foundations. These four [illegible]umns are supported therefore by a steel [illegible] which is built into this wall. The lower [illegible] is at the level of the second floor level (wi[illegible] forms the ceiling of the foyer), while the [illegible] chord is at the fourth floor level. The ge[illegible] arrangement is shown in Fig. 1, and the [illegible]ils of the truss are given in Fig. 2.

The truss has a span of 77 ft. 6[illegible] c. to c. of the supporting columns, and it [illegible] ft. 2 ins. deep c. to c. of chords. Its weigh[illegible] about 110 tons. The posts or verticals are [illegible]d by the columns of the upper floors, whi[illegible]re seated on the bottom chord. They are o[illegible] box section mentioned above, each cons[illegible]g of two 12-in. channels and two cover pla[illegible] 3/16 × 14 ins. The diagonal member of the [illegible]dle panel is of similar section. The chords, [illegible]lined end posts and two diagonals are of bo[illegible]ection, of the form and sizes shown in Fig. 3. [illegible]he chords have transverse vertical diaphrag[illegible] of ⅜-in. plate, with angle connections to the [illegible]ebs. The end post has a continuous diaphrag[illegible] as shown in Fig. 3.

The materials used in this truss ar[illegible] large and heavy sections, many of the plates [illegible]nd angles being 1 in. thick. One of the interesting features is the great size of the gusset or connection plates, all of which are 1-in. thick. The rivets are mainly ⅞-in. diameter, with 15/16-in. rivet holes. The holes in 1-in. material are drilled to full size. The holes in other material are punched 13/16-in. diameter, and then reamed to 15/16-in. Iron templates are specified for drilling and reaming.

The columns supporting this truss are of specially heavy section, on account of the great loads concentrated upon them. They are of double box section, with the arrangement shown in Fig. 3. There are three built-up webs, connected by cover plates on both sides. The connection with each end of the bottom chord of the truss consists of two 1-in. gusset plates 8 × 13½ ft., which are riveted against the sides of the column, chord and end post. The column section described extends to the third-floor level, which is just above the top of gusset plates of bottom chord connection. Above this, the section is reduced to a single box sec-

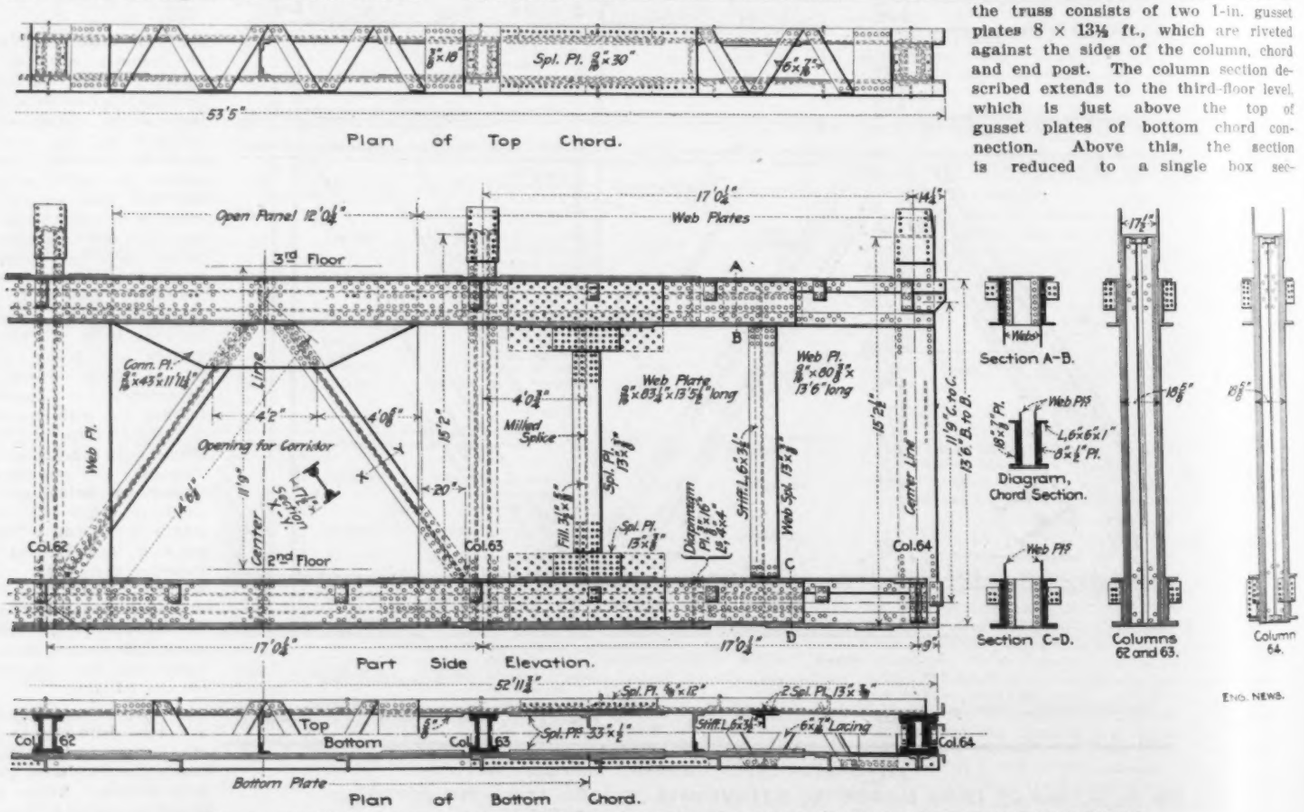


FIG. 4. DETAILS OF TRUSS GIRDER SUPPORTING INTERMEDIATE COLUMNS OVER THE DINING ROOM.

GIRDER TRUSS OVER THE DINING-ROOM.—In the southeast corner of the first floor will be a large dining-room about 48 × 76 ft., occupy-

ing a space which includes six columns of the upper floor arrangement. These columns are supported therefore by three girders about 53 ft. long, each supporting two intermediate columns. These girders are 13 ft. 6 ins. deep, extending from the second floor to the third floor. Each weighs about 55 tons. The general arrangement is shown in Fig. 1, and the details are given in Fig. 4.

The design of these great girders is peculiar. For about 20 ft. at each end there are two solid web plates, forming a plate box girder. The middle panel, 17 ft., is left open in order to enable a corridor to pass through the girders. This panel has two diagonal truss members, as shown. In two of the girders the doorway is in the center of the panel. In the third, however, it is at one side; this necessitates an unsymmetrical arrangement of the diagonal members, as indicated by dotted lines in Fig. 1. The chords (Fig. 3) have four flange-angles, riveted to the plate webs, and to a heavy gusset plate in the top of the open panel. A reinforcing plate is fitted between the edges of the angles and a wider reinforcing plate is placed against this and the vertical legs of the angles. This construction is shown diagrammatically in Fig. 3.

The girders are attached to columns of the ordinary box section used throughout the building (2 channels and 2 cover plates), by means of large gusset plates 1-in. thick. These gussets are riveted to the sides of the columns and to the web plates of the girders.

ROOF OF THE MAIN BANQUET HALL.—On the 19th floor is a large banquet hall which is about 45 ft. wide and 130 ft. long, and which extends through the 20th and 21st floors to the roof. It occupies practically the entire length of the Madison St. side of the building. The principal structural feature is the use of steel arch trusses which span the hall and carry the roof, and the ends of which are shaped to form the supporting columns on either side. Between these columns are intermediate vertical ribs or posts carrying tee bars which support the ornamental tile for the mansard roof, which begins at this level (as noted above).

Fig. 5 shows the construction of one of the roof trusses. The leg on the street side rests upon top of the main floor girder which is supported by the column directly below it. The columns on this side do not extend above the 19th floor. The leg on the court side of the truss has no outer flange, but its web members (batten plates and lacing bars) are riveted between vertical connection angles on the face of the adjacent column, which column extends to the

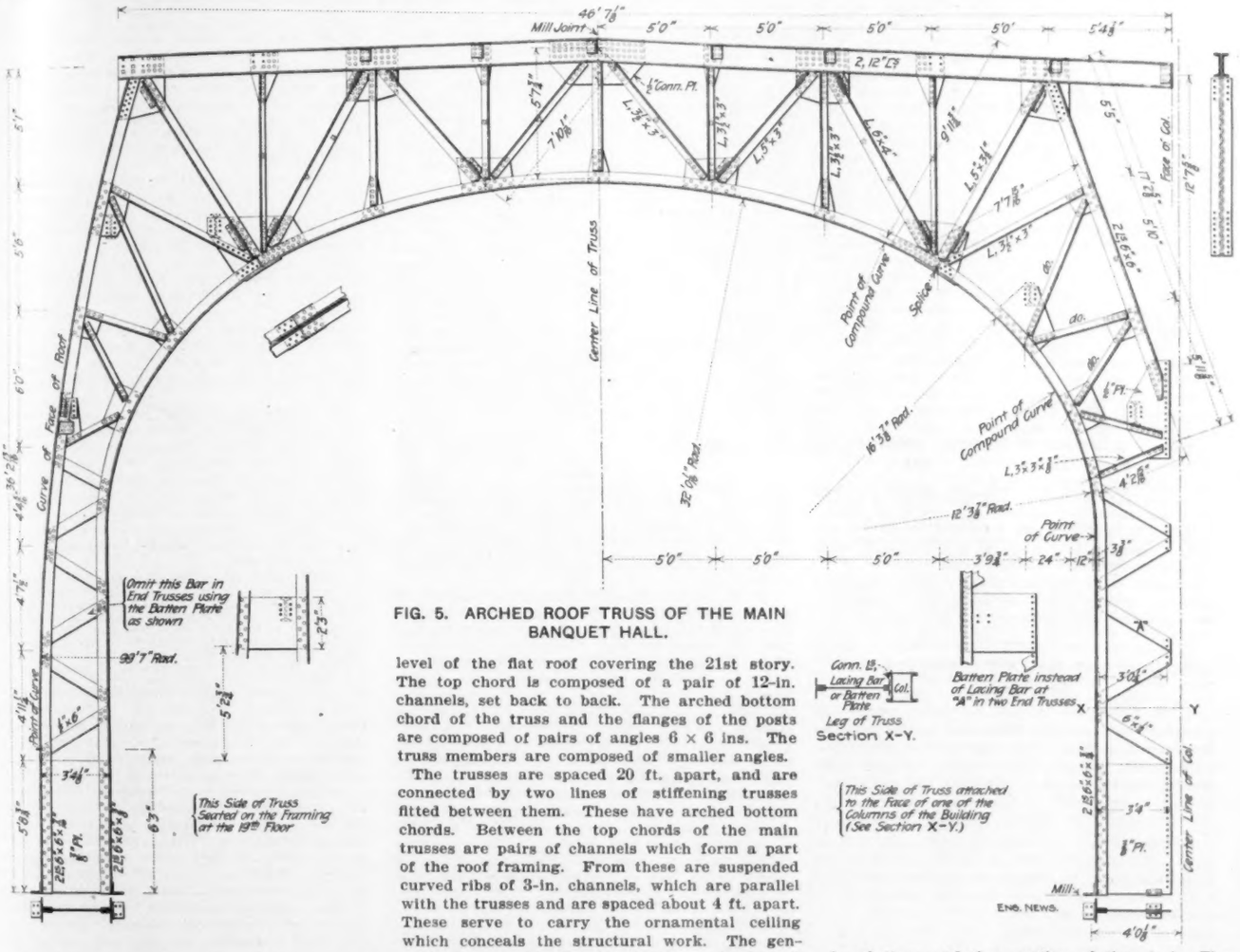

Mill Joint
46' 7⅞"
5'0"
5'0"
5'0"
5'0"
5'4⅛"
2, 12"ℂ's
Center Line of Truss
Curve of Face of Roof
Point of Compound Curve
Splice
Point of Curve
Omit this Bar in End Trusses using the Batten Plate as shown
99'7" Rad.
This Side of Truss Seated on the Framing at the 19th Floor
Conn. to Lacing Bar or Batten Plate
Col.
Leg of Truss
Section X-Y.
Batten Plate instead of Lacing Bar at "A" in two End Trusses
This Side of Truss attached to the Face of one of the Columns of the Building (See Section X-Y.)
Center Line of Col.
ENG. NEWS.

FIG. 5. ARCHED ROOF TRUSS OF THE MAIN BANQUET HALL.

level of the flat roof covering the 21st story. The top chord is composed of a pair of 12-in. channels, set back to back. The arched bottom chord of the truss and the flanges of the posts are composed of pairs of angles 6 × 6 ins. The truss members are composed of smaller angles.

The trusses are spaced 20 ft. apart, and are connected by two lines of stiffening trusses fitted between them. These have arched bottom chords. Between the top chords of the main trusses are pairs of channels which form a part of the roof framing. From these are suspended curved ribs of 3-in. channels, which are parallel with the trusses and are spaced about 4 ft. apart. These serve to carry the ornamental ceiling which conceals the structural work. The general plan of this framing is shown in Fig. 6, while the stiffening trusses and the ceiling ribs are shown in Fig. 7.

ROOF TRUSSES OVER THE SMALL BANQUET HALL.—The small banquet hall, about 44 × 66 ft., is on the 19th floor, and its ceiling is

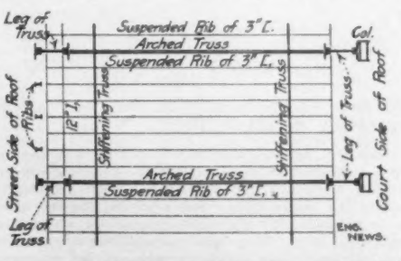


Fig. 6. Part Plan of Roof Framing of the Main Banquet Hall.

formed by the 21st floor. As no columns are admissible in the room, the intermediate columns within this space end at the 19th floor. The 21st floor, therefore, is suspended by hangers from four parallel-chord trusses in the roof. This arrangement is shown clearly in Fig. 8.

ENGINEERS AND CONTRACTORS.—The architects for the La Salle Hotel are Holabird & Roche, and the structural steel and the foundations were designed by the firm of Purdy & Henderson, consulting engineers. These two firms have been associated in the same capacity on the two new Chicago public buildings: the Cook County Court House (now completed) and the City Hall (soon to be commenced). The general contract for the La Salle Hotel was awarded to the George A. Fuller Co., which did all the construction by its own forces, including the foundations and the erection of the steel. The latter work has progressed with great rapidity, and has averaged two floors per week. The steel work was manufactured by the American Bridge Co. All the firms mentioned are located in Chicago.

THE SOLUTION OF THE DUST PROBLEM on macadamized roads is remarked on as follows in a report by Mr. J. Henry Taylor, M. Inst. C. E., Borough Engineer of Barnsley, England:

It is well known, of course, that the real cause of the increased expenditure necessary for keeping down the dust on the main roads is the greater use of traction engines, motor cars, and motor wagons, but I incline to the opinion that the placing of a tax or rate upon the owners and users of motor cars and motor wagons by itself is an insufficient way of making a permanent improvement to the roads. I consider that the proper plan would be either to construct separate motor tracks for rapid traveling at speeds exceeding ten to fifteen miles an hour throughout the county for motor cars and motor wagons, or that all the roads used by motors should be reconstructed with both new foundations and surfaces where necessary, and such surface specially prepared with ingredients consisting chiefly of tar, bitumen, or other similar substance, and that the cost of providing these

special tracks, or of specially reconstructing the roads should (as a matter of national importance) be borne by the Government, who are the best able to control or regulate this description of traffic, and who ought to encourage this comparatively new industry, which is becoming great and extensive.

I also consider that the time has arrived when heavy traction engines, such as are now so largely in use, should be prohibited from traveling along our highways, as they are the chief cause of the damage, not only to the surface, but, in many cases, to the foundations of

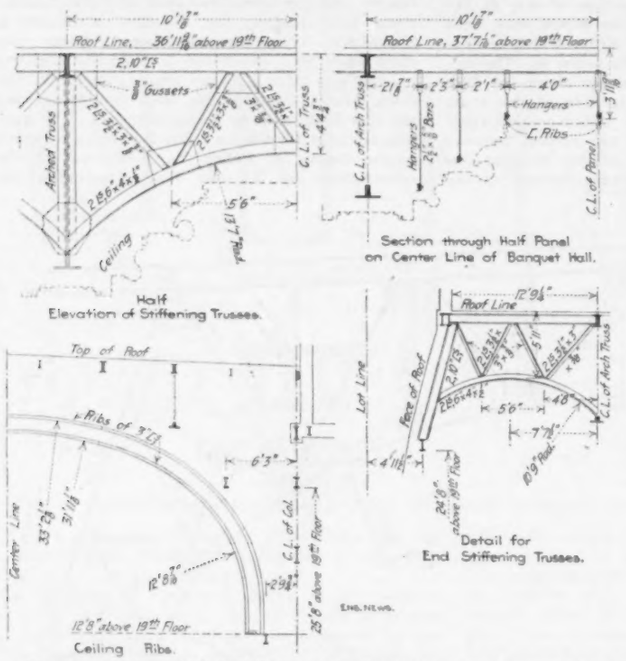


FIG. 7. STIFFENING TRUSSES AND CEILING RIBS OF BANQUET HALL.

our roads, rendering the roads less suitable for both motor and ordinary traffic, and more liable to become dusty and muddy than with any other means of traction. I would not include in this prohibition the traction engines used for drawing threshing machines and other light agricultural implements along the King's highway. They do comparatively little damage to the roads.

The population of Barnsley is about 41,000. The foregoing excerpt was taken from the London "Local Government Officer and Contractor" for Oct. 10, 1908.

THE TESTING OF PORTLAND CEMENT FOR USE IN THE TROPICS.

In the Philippine Islands the large amount of construction since the American occupation has demonstrated that cement as manufactured for a temperate climate has certain marked deficiencies in the tropics and that the tests prescribed by the best standard specifications are not indicative of future behavior in tropical countries, though they may be correct for a temperate climate. In view of these facts the Bureau of Science at Manila, P. I., has instituted a series of investigations into the properties of cement with special respect to hot climates and, as a coordinate study, into the methods necessary in testing to ensure a cement for such climates. The first report of these investigations has just been published in the "Philippine Journal of Science" (V. 3, No. 3, June, 1908) in an article entitled "Portland Cement Testing," by Messrs. W. C. Reibling and L. I. Salinger, of the Chemical Laboratory of the Bureau of Science.

The paper is quite lengthy and includes a number of tables and diagrams enumerating experiments which tend to prove the various statements made. On account of lack of space we have omitted in the abstract of the discussion given below a considerable portion of the less important parts and all of the tables, leaving the study of the latter to those who are deeply interested in the subject and who may obtain a copy of the original from the Philippine Bureau of Science. The extracts are of considerable interest; the first part to all cement users on account of its reference to the well-known variability in the results of different cement-testing laboratories working under the same specifications and the remainder to all who have occasion to use cement in a hot and damp country.

The abstract follows:

INTRODUCTION.

This paper is devoted to a discussion of modern cement specifications and we have endeavored to point out many reasons why they do not exclude the personal error that is experienced by all testers working under them. Simple methods and precautions necessary to reduce this variation have been suggested. Throughout the discussion, the effects of the requirements of cement specifications, the difference possible in manipulation and the consequent variations in the results obtained have been illustrated. Certain powerful climatic influences that tropical conditions may exert upon cement are also discussed, and the last chapter suggests the characteristics which a cement should have to give the greatest efficiency under tropical influences.

SPECIFICATIONS.

The value of standard specifications to the engineer, the consumer, and the country at large is as great as their value to the manufacturer. A standard specification, provided it is both equitable and safe, cheapens the product, insures quicker deliveries and acts as a powerful regulator to the industries affected. . . . *The danger of a fixed standard of any kind lies in its becoming unprogressive and following behind the demands of the time.*

The last sentence should be especially emphasized. All official cement testing in the Philippines at present is done under the U. S. Army Engineer Specifications of 1902. No change has been made in these specifications in the last six years despite the great amount of work which has been done upon the physical and chemical properties of Portland cement in recent times, and, in the light of experience, it has been found that these specifications could certainly be improved. This unprogressive tendency is, perhaps, due to the inertia inherent in all committee work. Each individual member has fixed ideas on certain questions, or on the results of certain personal experiences. As one writer puts it: "We are all disposed to argue somewhat on the basis of our prejudices or to refute others because of the prejudices which we associate with them. . . . Therefore it is difficult for us to arrive at conclusions purely by the light of reason, and to deal with every syllogism from its premises to its conclusions."

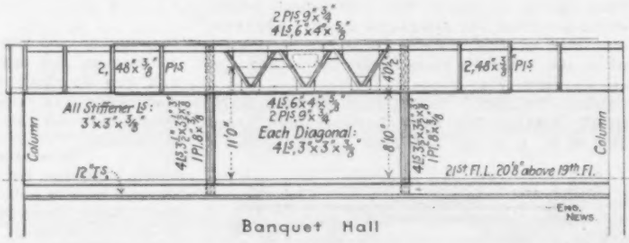


FIG. 8. ROOF TRUSSES AND HANGERS SUPPORTING THE FLOOR ABOVE SMALL BANQUET HALL.

However, the American Society of Civil Engineers and the American Society for Testing Materials are constantly working to improve their cement specifications and these specifications will soon be adopted by the Government of the Philippine Islands for all civil and municipal work. They have accomplished much towards establishing a more practical, impartial and comprehensive system of testing. Yet notwithstanding that so much has been done towards unification of methods, it may never be possible to determine accurately the value of one cement as compared with another tested in a different laboratory.* Experience since the report of the committee has made has shown that the difficulties in the way of uniformity in such tests are much greater than was imagined. The variation in the results of tensile tests between the work of different experienced operators working by the same method and upon the same material are frequently very large and often make a difference between rejected and accepted cement. The difference in tensile strength with neat cement of 40 differences in uncommon, while for sand mortar 20% are not greater.† are much

At present all standard specifications much to be desired. A Government committee appointed to investigate the quality of a certain brand of cement, after much consultation with engineers, chemists, contractors and manufacturers, introduced its final report with these remarks:

There are no standard specifications which are regarded as absolutely correct. All tests are approximations and must be interpreted in accordance with the specifications in use, and with due regard to the purpose for which the cement will be used.

There is no practical difference between the qualities and properties of a rejected and of an accepted cement in the immediate vicinity of the limits fixed by specifications.

It follows that the engineer may be in much doubt as to whether to reject or accept a cement.

It must be recognized, however, that cement specifications are not for average results, but are intended to cover the lowest limit which can be allowed in the work and to provide for lack of uniformity in testing as well as in real quality.‡

Such a conclusion may be satisfactory to the engineer, but should the tests be close to the margin specified for acceptance, the selling agent is sure to protest and order a retest of the material. He may allow the original tester to retest the cement, or he may send the samples to one of the many commercial laboratories whose reputation for high results in cement testing is well established. The retesting may produce satisfactory results in either case owing to the weakness of all cement specifications. "It is not to be inferred, however, that the highest results are necessarily the outcome of the greatest skill. As a rule, the most expert and reliable operators get only moderate strength for the best material.§

Such a condition of cement testing is very deplorable. Unless specifications guarantee an accuracy within 10%, the greatest efficiency of a cement laboratory is also lost, as the mere mechanical routine testing of various brands of cement should be the least important part of its work and satisfactorily to accomplish the more important object, namely a systematic study of the peculiar effects of climatic conditions upon them, a variation factor of not more than 10% is essential.

Sabin states that

the chief object of testing cement is to arrange the various products in their true order of merit. Cement is at present used in a very crude way and it is only in exceptional cases that poor quality of material may be detected in the completed structure. This is sufficient reason why so few failures can be found in cement work which may be attributed to the poor quality of the cement. But in the more economical manner in which the material is, even now, being used, it is absolutely essential to know what its future behavior will be.

We believe that the inefficiency of all American specifications lies in the fact that they do not outline sufficiently in detail the minor considerations and operations, and that to these minor details, owing to the peculiar and sensitive character of cement, is readily attributed a possible variation in the results of testing of 30 to 40%. There are certain qualities in cement manipulation that can not be controlled, such as the size, shape and intermingling of crystals, nonhomogeneous voids in sand briquettes, unequal action of the water upon the hardening of briquettes, etc., but we believe that by far the greater variation is caused by the different manner in which different laboratories interpret the minor details of manipulation and treatment; and we also believe that if specifications were more explicit in this respect it would be safe to predict that different laboratories would agree within 10%. This assumption is supported by the well-known fact that the system of the individual laboratory usually produces fairly uniform results, but a comparison between different laboratories which differ only in those details not explicitly treated in the specifications, often show the most startling inconsistencies.

THE EFFECTS OF AERATION.—Most of the cement specifications now in use devote considerable space to the manner in which the samples should be taken, but they all neglect to state how these samples shall be stored and preserved until tested. As a result, they may be sent to the laboratory in wooden or paper boxes, paper or cloth bags, tin cans, galvanized-iron cans, glass jars, etc. The cloth and paper may be thin or thick, and the cans, jars and boxes may have tightly or loosely fitting covers, or even no covers at all. These

*Sabin, Louis Carlton: Cement and Concrete. New York (1905), 30.

†Spalding, Frederick C.: Hydraulic Cement. New York (1904), 115.

‡Taylor and Thompson: Concrete, Plain and Reinforced. New York (1907), 99.

§Spalding.

samples must be tested as soon as they are received at the laboratory, or, owing to the amount of routine work already on hand, they may stand for some days before being worked. As a result of all these conditions the cement may have been subjected to unequal aeration and its characteristics changed accordingly; this change has often been sufficient to alter the resulting tests from satisfactory to unsatisfactory.

Experience in this laboratory has demonstrated that in most instances variations are encountered in cement samples which have been received in thin paper bags, or which have otherwise been exposed to the air; and that cement received for testing in closely covered cans and boxes and not subsequently exposed to the air, usually gave very acceptable, uniformly good results.

It has been shown [by laboratory tests given in original paper.—Ed.] that cement, otherwise susceptible to a marked change by exposure to air, when preserved in closely covered galvanized-iron cans will be little affected by storage; and that thin paper bags do not eliminate the atmospheric influences. It has also been shown that the characteristics of a cement often undergo a change upon exposure which may be sufficient to make failures of otherwise acceptable tests. Therefore, it is evident that no system of cement testing, however accurate, will insure uniform or even comparative results until a proper, specified preservation of the samples after they are taken from stock is made compulsory.

As a result of the considerations given above, it would seem necessary so to modify the ordinary procedure that the quantity of the cement deemed necessary for the desired tests should be freely exposed to the atmosphere of the laboratory for seven days in a layer 1 in. deep, in order to determine the effects of aeration. A comparison of the specific gravity, setting time, and loss on ignition of the cement before and after exposure, will give valuable indications as to its nature. The determinations made before exposure will be consistent with the quality of the cement at the time the stock was sampled, and the second treatment will show the qualities liable to be developed by subsequent storage. If the effect of exposure is considerable, troublesome variability of the brand may be readily attributed to this cause and the manufacturer will then know how to improve his product accordingly.

Changes caused by the atmosphere penetrate very slowly into the mass of the cement in barrels, because the wooden staves and heads keep the air from the product to a considerable extent and the mass of material is large, therefore, alterations which may develop very rapidly in a small sample exposed in the laboratory would not take place in the barrel until a much longer period of time had elapsed. Spalding states that

> the effect upon cement of retaining it a long time before using depends upon the nature of the cement and the method of keeping it. When the cement is inclosed so as to prevent the access of air, as in barrels, it may usually be preserved for a considerable time without experiencing any alteration, provided it is kept dry.

The fact that cements stored in good barrels undergo very little change by a month's seasoning is illustrated by the original and the re-test of a cement in which the samples for the re-test were taken a month after the original ones. All the samples were protected from aeration before testing, and the re-test gave only slightly lower results, although subsequent experiments showed that the cement rapidly deteriorated in time of setting and tensile strength when subjected to air exposure.

Many engineers maintain with good judgment that a cement should not develop dangerous properties on exposure to the air and if it does so it merits rejection, especially if the unexposed samples show irregularity, since it is only practicable to test one barrel out of every ten or twenty in stock. It is also true that barrels often become broken in shipment, and should the cement which is so received develop dangerous properties, the strength of a whole structure might be weakened by its use.

THE DISPOSAL OF CAKED CEMENT.—It is usually specified that cement shall be screened through a 20-mesh sieve and thoroughly mixed before testing. The object of the sieving is to break up lumps and remove wood splinters, stones and other foreign substances. Such a procedure is of course proper. However, under certain conditions, the disposal of caked cement when it is present in considerable quantity should be more fully described.

Cement literature has repeatedly pointed out that the tensile strength of a caked cement is considerably below that of the original material before it formed lumps. This is due to the absorption of moisture and the subsequent partial setting. The disposal of these lumps, then, especially those which are too hard to be broken up in the process of sieving, may exert considerable influence in the tensile strength obtained. If one tester pulverizes the hard lumps and mixes this powder with the original sample, and the other simply throws them away, uniform results can not be expected.

Should the cake be present in sufficient quantity to affect the tensile strength appreciably, the person requesting the tests should be notified of this condition. The presence of the cake may not be due to any fault or carelessness on the manufacturer's part. Improper storage while in the hands of the engineer or contractor may have caused it. Instances are also on record in this laboratory where caking was induced in the samples after they were taken from the stock. The samples were taken during a rain storm and through carelessness and incompetency on the part of the one handling them, they were allowed to get wet.

If specifications are to guarantee uniform and just results in all cases, the treatment of caked cement must be more fully described than it has heretofore.

INFLUENCE OF TEMPERATURE ON TIME OF SETTING.—The general rule for all cements is that increase of temperature increases the rate of setting. However, there is no fixed ratio between the temperature increase and the accelerated setting produced by it. The published reports of skilled operators vary in this respect, and L. Tetmaier, after years of the most careful work was forced to admit that "different cements are differently influenced by alteration of temperature . . . and it is scarcely possible to deduce a general law for even one class of cements."

The results we have obtained on the setting time of various cements, worked in the cold-storage room and at local temperature, have shown that the samples, in this respect, could be divided into three classes:

1. Slow setting cements, little affected by a variation of temperature from 20° to 30° C.
2. Cements which are slow setting at 20° C. but quick setting at 30° C.
3. Cements which are quick setting at 20° C. and also at 30° C.

Below we give our own tabulation of the four sets of experiments noted above, under the class and the number of tests and the set intervals for the lowest and highest temperatures in each class. The specimens for intermediate temperatures grade between these two in a fairly good straight line curve.

The temperatures of the materials in the mixing room and the setting room were practically the same for all except the second part of the second class, in which each of four constant making-temperature tests was divided into two parts, to set respectively in a high and a low temperature.

Class.	No. of tests.		Mixing Temper.	Setting Temp.	Set—Initial.	Set—Final.
1.....	9		min 66	66	2:35	6:15
			max 84	84	2:25	4:15
2a.....	8		min 67	67	3:50	5:00
			max 88	88	0:25	2:30
2b.....	8	min	70	70	2:15	....
			70	90	0:55	2:10
		max	90	90	0:21	1:21
			90	70	0:38	....
3.....	10		min 64	64	1:40	....
			max 85	85	0:24	....

Note: 20° C. = 68° F.
30° C. = 86° F.

See further comment on this subject in the portion of the report under heading "Climatic Influences."

MOIST-AIR CLOSET.—Another possible source of error which may be accountable for considerable variation may develop during the moist-air treatment.

Most specifications allow the briquettes to be stored for the first twenty-four hours in a moist-air closet or under a damp cloth. Moist-air closets are given the preference, as unequal drying often occurs in using the damp cloth. A well-constructed moist-air closet is essential to uniform results.

One condition in the use of a moist-air closet that is liable to have considerable influence upon the result of the cement tests should be taken into consideration. This is produced by the heating of the cement after it is gaged and molded. Many cements heat considerably at some period of the stage of early setting and hardening, the rise in temperature often being as much as 10° C.; it may take place in five minutes, or it may not occur until many hours after the gaging.

C. Prussing states that "many slow setting cements of excellent quality begin to set after five or six hours and then set completely in one hour, giving a rise of temperature of 5° to 7° C." The heat generated by briquettes placed under a damp cloth is not confined, as it is readily conducted away into the surrounding atmosphere. Moist-air closets are constructed to insulate the interior from outside heat influences as much as possible, and as a result the heat generated by the briquettes is confined; so that in a cubical moist-air closet of 2 ft. on the side which was used to store briquettes after they were removed from the molds, the temperature often rose to 40° (30° being room temperature) when it held from 80 to 100 briquettes. A number of slow-setting briquettes made at different successive intervals of time, or worse still, a mixture of quick, normal, and slow-setting cements, will under these conditions not be subjected to the same uniform temperature, or to a temperature change that is characteristic of it during its most critical setting and hardening period; and the same is true of the storage of pats made for the time of setting when many are placed in one compartment after gaging.

It is well known that the temperature conditions under which cement sets and hardens will influence its tensile strength. Therefore, the practice of storing numerous briquettes in one compartment of a moist-air closet is very liable to cause abnormal one, seven and twenty-eight-day breaks of some of them. Pats for time of setting similarly stored may be also affected to such a degree that an otherwise slow-setting cement may become quick setting.

We suggest two ways of overcoming this objectional feature of the ordinary closet. The heat generated by the setting cements may be conducted away by means of a forced ventilation of air saturated with moisture; or only briquettes and setting pats of the same cement made at practically the same time should be placed in a small, insulated compartment. The former method will maintain the interior of the compartment at nearly the same temperature as that of the laboratory, while the latter will meet the conditions of actual service, as the heat generated by the cement is not readily conducted away. Laboratory tests should coincide as closely as is possible with the actual conditions of construction work, where large volumes of concrete are tamped into wooden frames. The heat generated in such a large mass (especially in the center of it) is not conducted away by ventilation and it is in fact partly insulated by the wooden molds. Therefore, a moist-air closet formed of several small, insulated compartments, each with its own pan of water, is best adapted for the purpose. Such a moist-air closet has been constructed for this laboratory.

Standard cement specifications should include a definite form of moist-air closet with a complete description of the materials for its construction, its dimensions, and directions for its use; otherwise one source of the so-called personal error will persist.

TIME OF SETTING.—The American Society of Civil Engineers has adopted the Vicat needle method for determinations of the time of setting. It seems to be the general impression that the Gillmore method does not insure the desired accuracy, and many cement testers will regret that such a convenient and time-saving process has been supplanted by a more cumbersome one; still, the Gillmore method, if properly regulated, can be made accurate, reliable and impartial and at the same time retain its simplicity, even though the meager directions in the U. S. Army specifications do not insure uniform results between different operators and at times imposes unjust tests upon some good cements.

Merz, Meyer, Schiffner, Bohme and many others have each pointed out that to determine the time of setting of a cement it should be gaged with a quantity of water proper to it. It has often been demonstrated in this laboratory that 20% of water is not enough to meet the requirements of the fineness, specific gravity, chemical composition, and physical properties of many good Portland cements sufficiently to produce a paste plastic enough to be molded into a pat. The resulting paste is often so dry and non-cohesive that it will not stick together or to the glass plate; and yet 1 to 3% of water in addition will produce the desired plasticity and cohesiveness.

The whole phenomenon of the manufacture of artificial stone from finely powdered cement is one of solution, hydration and subsequent crystallization. The addition of sufficient water is essential for proper solution and hydration. The addition of too much water is to be avoided because of its effect upon the subsequent crystallization, and because the density of the paste must allow of proper manipulation. Therefore, it is very evident that plasticity and not a given percentage of water should be the condition regulating the paste for cement pats.

The insistence of the U. S. Army engineers upon a paste gaged with 20% of water seems to be a striking illustration of Spalding's assertion that "tests may be imposed which in nearly all cases will secure good material, but often at the expense of rejecting equally good or better material."

Merz, Meyer, Schiffner, and others also insist that even when cement is gaged to the proper plasticity there is a large personal error due to the operator himself. After a careful study of this personal error, we have come to the conclusion that it is mainly due to the following five causes:

1. The manner of applying the needles.
2. The presence of small air bubbles near the surface of the pat.
3. The difference in the amount of water brought to the surface in patting the cement together and its presence there in a more or less liquid layer.
4. The difficulty in judging the exact time when the needles cease to make a "visible impression."
5. The difference in plasticity.

To overcome the first difficulty the pat should be made with a flat (not rounded as specified) top. The needle should then be applied very gently and after the flat point rests upon the surface of the pat the full weight of the needle should gradually be applied. Fail-

ure to hold the needles in an exactly vertical position will often cause the edges to indent where the flat point would not.

To overcome the second, third and fifth difficulties, the cement is gaged with the least amount of water which after one minute's soaking and four additional minutes of vigorous troweling will produce a paste sufficiently stiff to retain its shape, and yet so plastic that the initial needle will sink almost to the glass plate when applied directly after forming the pat. A ball of this paste when dropped from a height of 70 cm. will flatten very slightly and will not crack. A lump dropped from the point of the trowel will leave the surface of the latter comparatively clean. In forming the pat the cement should be thoroughly patted together with the flat of the trowel. This eliminates the air bubbles near the surface and also brings the excess of water to it. In forming the flat top, the hyperaqueous cement should be wiped off as much as possible with the edge of the trowel, and the surface left smooth and firm.

Difficulty number five is especially marked in slow-setting cements, as sometimes a slight indentation will persist for hours and in the judgment of an individual operator, may even not be fixed within 30 to 60 minutes. However, this uncertainty can be greatly overcome if the needle is carefully applied at intervals of 5, 10, 15, or 20 minutes, according to the rapidity of set, indentations being made in a row. After the pat has become dry, the point where the needle ceases to penetrate is easily recognized (especially so if the surface is slightly moistened), and the time can then be calculated according to the number of previous indentations.

This method, once the details are mastered, is just as convenient and quick as a less accurate one. For research work and for cements the setting qualities of which are close to the requirements of specifications, it is especially valuable, as we have found that two pats of the same paste will compare almost exactly, and that even different operators will not vary 10% if they are careful and efficient.

However, it has been our experience that, as Spalding states, "the rate of setting neat paste gives but little indication of what the action may be with sand." Several instances of satisfactory neat and unsatisfactory mortar tensile strength have been encountered in this laboratory, because of the more rapid setting of the cement when combined with sand. It is deemed sufficient to state here that the mortar and neat set must vary because of the differing percentage of water which is used, the difference in physical manipulation, in the air exposure, in mixing, the physical and possibly also the chemical influence of the sand.

For the thorough study of the nature of some cements the determination of neat and mortar setting qualities may be essential. A simple method to determine the setting time of a mortar is here suggested. The beginning of setting when sufficiently rapid appreciably to influence the briquette manipulation is characterized by sudden drying and a slight stiffening of the mortar. If a mixture is made as if for briquettes and the mortar then placed on a glass plate and divided into cubes with the trowel, a slight set may readily be detected when a cube, upon being crushed between the finger and thumb, feels dry, crumbles apart and offers a slight resistance to the crushing force. A harder set may be arbitrarily fixed and determined when the setting has progressed to the extent that a one-inch cube dropped from a height of one foot will not crack.

However skilled the operator may be, or however accurate his method, uniform results even by the same operator and on the same cement can not be insured unless the precautions described under the previous headings of "Effects of Aeration" and "The Moist-air Closet" are heeded. Thus, the first sample taken from near the surface of an exposed package not previously mixed, may not set for hours. When it is desired to make a series of comparative setting tests on the same cement it is advisable to remix the sample thoroughly before weighing and then store the cement in tightly stoppered, wide-mouthed bottles until it is used. The pats should be stored in insulated compartments of the moist-air closet to avoid the influence of the heat liable to be generated by other pats during setting.

SOUNDNESS.—Tests for soundness, like setting pats, should be made with a paste of the correct plasticity. If too little water is used in gaging, the cement will not adhere properly to the plate, and lack of cohesion in the cement itself may result in cracks not due to its subsequent expansion or contraction. If too much water is used, shrinkage cracks of such a nature as to be easily mistaken for evidence of unsoundness, may occur. This laboratory uses the same plasticity in its tests for soundness as for setting pats. The cement in this condition is thoroughly wet and pliable, but still stiff enough to retain its shape, and therefore it meets all the requirements of a just test. Uniformity between different testers is also secured, because 1% of water more or less would so change the nature of the paste that it would be rendered either too dry or too liquid. The results obtained depend much upon the skill of the operator. Sudden changes in temperature during the steaming and boiling tests should always be avoided. Moistening the surface of the glass plate with a damp cloth before applying the paste will insure better adhesion to the plate. A ball of the paste should then be applied to this surface and patted down very vigorously into the desired shape. Vigorous patting with the flat of the trowel eliminates any interior cracks, reduces the air bubbles to a minimum and brings the excess water to the surface. For soundness, the top of the pat should be arched and the rim troweled to a thin edge. Pats made in this manner will not warp or crack unless the cement is faulty.

We have noticed that different testers interpret the results of soundness tests in different ways. Some operators will report as "unsound" a cement that shows the least trace of warping even after air exposure. Cements showing only slight incipient disintegration are often reported as "disintegrated." In like manner "off plate" and "cracked plate" are often attributed to expansion and contraction. Such an interpretation is unjust to the manufacturer, as warping and cracking to some extent under certain conditions are not to be considered dangerous. A sound pat combined with a broken plate does not necessarily indicate dangerous contraction or expansion. Every cement expands more or less, and in this case the adhesion between the cement and the glass is very strong. As the glass also has an expansion factor, all such cases should be reported as satisfactory if the pat itself shows no sign of cracking or warping. To insure a perfect understanding between the manufacturer, engineer and tester and to avoid unjust or misinterpreted results, specifications should include a descriptive chart of the proper standard interpretation by which the extent, significance, and importance of the various degrees of warping, cracking, disintegrating and shrinking are to be regulated. This laboratory has adopted the standard portrayed and described by Taylor and Thompson* in order to insure a complete comprehension in this respect.

Much diversity of opinion exists regarding the rejection of a cement which fails to meet the boiling test, but we regard such a cement as dangerous if it is to be used in works exposed to the heat of the tropical sun.

Excess of lime, coarseness of grinding, insufficient seasoning, and underburning of a cement may cause it to fail to pass the soundness test. If lime is the cause, storage may eliminate the defect, as the free lime would thus be changed to the carbonate, or slaked, and so would not cause subsequent expansion.

Many engineers believe that failure to pass the hot test is not a proof of inferiority, as the cement so failing, if mixed with sand or some other aggregate, has produced durable masonry; it is also a known fact that thoroughly slaked lime paste can be added to a Portland cement mortar without injurious results. We suggest that, as is the case in determining the time of setting, some specification be devised to test the mortar mixture as well as the neat paste.

TENSILE STRENGTH.—The variation in the breaking strength of both neat and sand briquettes is a source of trouble to every cement tester, and despite every effort to eliminate this error, breaks continue to be variable with a persistence that makes it necessary to double or treble the number of briquettes otherwise required. We have made a thorough study of this variation and as a result have come to the conclusion that only a portion of it is due to the personal error of the operator, and that the remainder is caused by the characteristics of the cement itself.

Personal error even with the most careful manipulation, may be produced by (1) unavoidable variation in troweling; (2) difference in the force of the blows; (3) lack of equality in forming each layer of the briquette; (4) variation in the size and shape of the mold; (5) difference in the size and shape of the sand particles; (6) personal error in machine operation; (7) unavoidable internal strains and voids caused by the manipulation which the specifications impose; (8) the impossibility of securing a perfectly homogeneous mixture; (9) variation in drying.

The errors caused by the natural characteristics of the cement, and which need more extended explanation, are as follows:

1. It is obvious that it is impossible to expose the same number of cement particles to the action of the air for the same length of time in each instance during troweling; those outside will be exposed more than the inner ones and the evaporation caused by contact with the air may cause setting. We would expect a greater variation from this cause in quick setting cements than in slow ones; and our experience has confirmed this. Slow setting cements give the least variation in tensile strength.

2. Another cause of variation is the tendency possessed by some cements to enclose air bubbles, thus producing irregular voids.

3. Unequal hardening of the exterior and the interior of the cement briquettes may cause differences in heat generated during setting and variable water action during submersion. This cause may also produce internal strains and voids. This variability would also be especially marked in quick setting cements.

4. Irregularity in the intermingling of the crystals during crystallization.

In continuation of this subject the report recommends a more systematic method of tamping (similar to one which is used in the Manila laboratory and which is described) the use of a standard testing machine and a amount of water determined from the moisture present on the tamped specimen and not by a percentage. There is a lengthy discussion of specific gravity in the determination of the value of cement, but we have space only to reproduce the following short summary:

SPECIFIC GRAVITY.—We do not think that the requirements of specific gravity should be omitted from specifications. This test is of great value under certain conditions. Every good Portland cement will meet its requirements before or after ignition, and therefore its determination imposes no unjust or partial test.

Determination of the specific gravity will be valueless unless the effects of aeration are guarded against, as the exposure of the small quantity of cement necessary for this test enables the action of the atmosphere to alter its composition very much in a short time and so to reduce its specific gravity accordingly.

CLIMATIC INFLUENCES.—Local, tropical, climatic conditions must necessarily have an influence upon cement and cement testing. In the tropics, all work is done practically in the open air, being protected only from the direct rays of the sun. The climatic conditions under which cement tests or commercial work are undertaken coincide very closely with the meteorologic observations.

All the requirements of standard American cement specifications are based upon cement action characteristic of a colder climate. It would be possible, of course, to manipulate the cement testing itself in tropical countries at the temperature limits specified in American standards; but this could only be done at great inconvenience and at a large expense and furthermore it would not be practical, as the results of tests so conducted would not be true criteria of the behavior and value of the cement when used in construction work. The allowances and requirements due to the effect of the relative difference in temperature between temperate and tropical climates should therefore be taken into account in local cement specifications.

During the past year this laboratory has received a number of letters upon this subject from manufacturers, engineers, contractors, testers and other cement workers. These either request information or make statements regarding the influence of local climatic conditions upon various phases of cement action and manipulation. A diversity of opinion has been expressed in regard to the effect of these influences by men familiar with cement work, and probably this is due to the fact that Portland cement is a very variable product and therefore local conditions which would improve the quality of one brand would injure another, and vice versa, and during the past year our endeavor has been to secure a sufficient number of results with various brands of cement to throw some light on the effect produced by this climate on the tests.

Careful cement testing with due consideration of all conditions is of the greatest importance in a country such as this, where much of the material comes a long distance by sea, and where the rejection of a shipment means a proportionately greater loss to the dealer, owing to the cost of transportation, and also to the engineer, as construction work may be delayed. On the other hand, construction work is very expensive in this Archipelago and therefore a rigid interpretation of specifications is necessary to provide against all possibility of the use of dangerous cement.

Contrary to the general belief, the difference between local climatic conditions and those of the temperate climates exerts very little influence upon the usual standard Portland cement tests themselves. Provided the cement is of good quality the warmer temperature prevailing here usually tends to give higher results. Of course, the fineness is not affected by it, and the specific-gravity determination is made independently of the surrounding temperature. The "accelerated soundness" tests especially, are benefited, as the cement does not suffer as great a change in temperature; and hence expansion and warping is not so marked. Climatic conditions improve the characteristics of early tensile strength of most cements, as the variation in temperature from day to day and from hour to hour is only slight, the temperature of the water bath is higher than in cold climates, and the temperature during gaging is also higher; these are all factors conducive to the development of high early strength. Comparative tests of both sand and neat briquettes made and preserved in the cold-storage room (17° to 21° C.) and also in the laboratory (26° to 30° C.) gave almost without exception lower results, from 3 to 10%, at the lower temperature.

*Concrete, Plain and Reinforced. New York (1907), p. 103-107.

The briquettes broke more uniformly when made at the colder temperature. The difference between the strength developed under both conditions was always slight and within the limits of personal error.

However, the relatively high temperature of this climate will seriously effect the setting properties of some Portland cements. Fortunately, the setting properties of the majority of cements are only slightly influenced by this difference in temperature. It is the experience of this laboratory that high alumina cements develop setting quality characteristic of class 2; further experimented work is necessary to determine whether this phenomenon is true only with this class. When comparatively fresh high-alumina cements set slowly at both temperatures additional seasoning renders them slow setting at first at 17° to 21°, but quick setting at 29° to 31°, and finally quick setting at both temperatures.

The development of quick setting is marked by other peculiar characteristics. When the absorption of carbonic acid and combined water has progressed sufficiently, no practical amount of water which can be added will retard the rapidity of setting or eliminate the early generation of much heat, but in the earlier stages of seasoning a variation of as little as 0.5% of water in mixing may produce a most remarkable difference in the time of the initial and final sets.

We are not prepared to discuss fully this at the present time, but the analogy to the phenomenon of the crystallization of certain salts from solution is striking. Many salts have a critical solution factor. Under slow evaporation they will remain in solution until a certain limiting percentage of the solvent has been reached, when the salt will crystallize almost instantly, heat being generated during the separation. A cement, the setting properties of which are so profoundly affected by the addition of even small quantities of water, may be said to have a critical solution (or hydration) point. We would hesitate to decide whether such a cement deserves to be approved. If tested according to the U. S. Army specifications it would fail to pass the setting test, but under those of the American Society the normal plasticity method will give it sufficient water to cause it to set slowly.

An engineer in these Islands related an experience illustrating the practical importance of this problem. The mortar, after mixing, was dumped into a car and transported to its destination by rail in five minutes. Working with a large shipment of this cement no difficulty was experienced for some time, but finally when one carload reached its destination the cement had set so hard that it was removed from the car only with much difficulty. He attributed this change to the variability of the cement, but we are inclined to believe that the water added was just sufficient to bring the cement to the critical solution or hydration point and that a bucket or so of water less than was usually employed, was used in mixing, and quick setting was the result.

Portland cement is most affected by local climatic conditions before and not after it is gaged. High temperature and the alternating humid and dry atmosphere are conditions under which hydration and carbonization are accelerated. In consequence, the majority of commercial products must be especially prepared to withstand tropical climates. Portland cement is very susceptible to changes under these conditions, and it is therefore essential to the best practice that cement intended for use in the tropics should develop no dangerous properties by the absorption of water and carbonic acid in normal quantities. The cement problem of tropical countries depends for its solution upon the characteristics of Portland cement; and our efforts have been to determine what class of cements are least injuriously affected by exposure and seasoning.

We believe that high-alumina cements are least efficient for use in tropical climates, although they have one laudable feature in that they never show the slightest inclination toward warping or disintegrating. Air, steam and boiling tests always develop perfect soundness. This is probably due to the fact that aluminous raw material fuses very readily at a comparatively low heat.

Lime burned at a high heat slakes much more slowly, and is therefore more likely to be injurious than when burned at a low temperature.

Aluminous cements gain most of their strength very quickly. "The aluminates are thought to contribute little to the final strength of the mortar, as they are not permanent compounds, but are acted upon by various salts with which they are likely to come in contact in the work. For this reason they are not adapted for work exposed to the action of air and sea water." "The aluminate acts in a very energetic manner upon the set, but very little upon the hardening which is caused by the silicate of lime.* From the character of the silicates and the aluminates it is evident that the latter are acted upon more quickly and rapidly than the silicates, and it is to the crystallization of the lime from the aluminates that the initial set must be contributed. Subsequent hardening must be due to the liberation of lime from the silicates.†

In conformity with these quotations, it has been our experience with cements of this nature that the 7 to 28-day gain is small; that satisfactory 7-day breaks do not insure satisfactory 28-day strength; that 7-day strength may be even greater than 28-day; that little gain in strength takes place after 28 days and instances are on record where the strength of the briquettes weakened after three months.

The fact that the early strength of this class of cement can not always be relied upon is probably due to its non-uniformity in burning. Owing to the fusibility of the calcium aluminate, which causes balling-up and sticking together in the hot zone of the kiln, thus preventing uniform burning, cements high in alumina are apt to be very erratic in the stability of their compounds. As a result the rapidity with which they unite with water and carbonic acid when exposed to the atmosphere varies. The relative rapidity of the absorption of carbon dioxide and water by cements under similar conditions would therefore indicate the relative degree of low burning.

The most important characteristic of a high-alumina cement and the one that needs the most consideration is its susceptibility to become quick setting by exposure to the air. It has been our universal experience that Portland cements of this class containing more than 8.5% of alumina always gave satisfactory results if they are tested before they have combined with more than 2% of water and carbonic acid; and that when they had combined with more than 3% of volatile constituents they failed to meet the setting and tensile strength requirements. It would seem as if there is something radically wrong with a cement that will not withstand atmospheric exposure to such a slight extent without developing dangerous properties, and such a cement should be rejected for use, especially in this climate.

The further discussion of the proper constituents of a cement best adapted for use in the tropics cannot be summarized here, but the essence is given in the conclusions noted on this page.

CONCLUSIONS.

At present we feel justified in drawing the following conclusions as being conducive to the best results and practice for all cement operations in this and similar regions.

1. We believe that the composition of Portland cement best adapted for use in tropical climate should be within the following limits:

	Per cent.
Silica	22 -24
Alumina	5 - 7
Lime	62 -65
Magnesia	0.0- 4
Sulphur trioxide	1.0- 2
Water and carbonic acid	0.5- 3

2. "Soundness" in accelerated tests deserve special attention here, because of the prevailing high temperature. Perfect soundness is especially important for concrete works which are exposed to the intense heat of a tropical sun.

3. "Underburning" is fatal to the efficiency of Portland cement to be used in the tropics, as the unstable compounds so formed are most easily attacked and decomposed by the energetic atmospheric influences.

4. All "sound" cements should be protected from additional aeration as much as is practicable, as otherwise quick setting or low tensile strength is liable to be developed.

5. Sound and well-burned cements, high in silica and low in alumina, will withstand climatic influences best both before and after gaging.

6. High alumina cements give fairly satisfactory results if they are used before they develop quick setting. Quick setting is sure to develop in such cements if they are exposed to the air for any considerable length of time.

7. Samples sent to the testing laboratory should be preserved in packages which thoroughly protect the cement from the atmosphere. No accurate results consistent with the quality of the cement as it exists in the barrel at the time of sampling will otherwise be possible. Setting tests made at the laboratory before and after exposure should be insisted upon, and if quick setting develops by this additional seasoning the cement should be rejected.

*Spalding.
†Clifford, Richardson: Eng. News (1905), 53, 984.

A FRUHLING DREDGE, costing about $300,000, has been purchased in Germany by the Dominion Government of Canada for work on the project for the improvement of the Fraser River, British Columbia. The dredge will cross the Atlantic, round Cape Horn and come up the Pacific coast of South and North America under her own steam. She is due to arrive at her destination about Feb. 1. This purchase was arranged by Mr. John Reid, 41 Park Row, N. Y. City. The Fruhling dredges were described in Engineering News, March 5, 1908. The Dominion Government has also appropriated $100,000 for work in 1909 on their improvement project, the total estimate for which is $3,250,000. The river and bar improvement was designed by Mr. J. F. Le Baron, M. Am. Soc. C. E., Chief Engineer of the Sumas Development Co., Vancouver, B. C.

CARE IN USING DYNAMITE ON THE ISTHMIAN CANAL WORK.*

Ninety steam shovel and powder men of the Central Division met the Division Engineer and Assistant Division Engineer at Empire, Sunday afternoon, November 1, for the purpose of discussing what additional means may be taken to guard against danger in the handling and use of dynamite. The meeting was called at the request of some of the steam shovel men and was the immediate outcome of the explosion which occurred in the Cut, near Empire, on October 8.

The conditions on the Isthmus are peculiar; in the first place, because of the magnitude of the work necessitating the handling in the Central Division of 700,000 lbs. of dynamite and the exploding of 260,088 ft. of holes each month; in the second place, because the material being excavated is not uniform, and the powder man and steam shovel man find themselves handling the hardest rock one hour, while the next hour they are likely to be working in earth or clay. These conditions should be a reason for greater caution on the part of the men, and it is advisable, therefore, that each steam shovel man take it upon himself to examine closely the work he is called upon to do. No one knows better than the steam shovel men who are working in the Cut day after day, and have been working there for months and years, when it is advisable to slow down in the work of excavation in order to proceed with safety.

In addition to the precautions already taken, the Commission has cabled for 15 galvanometers, to be used in testing the fuses, and for 48 additional Star drills. The galvanometers, added to those already in use, will make the number 25 for the Central Division, and each powder man in the Cut will be supplied with one. It will be his duty to test each fuse before it is placed in the dynamite cartridge; to test it after the hole is loaded; and finally, when wires have been strung to the battery, to test the circuit again in order to see that the current will enter every fuse. This will insure against defective fuses. In order to fire charges which may escape explosion when the current from the battery is turned on, holes will be drilled 12 ft. apart, after the arrival of the extra drills, instead of 20 ft., as is usual at present, and thus each hole will be so close to its neighbor that, even though one of them should not explode when the current is applied, the detonation from the nearby hole will set off the charge of dynamite.

There is now under consideration a plan to have a high-power live wire strung along the edge of the Cut from Pedro Miguel to the Chagres River, from which leads will be run at regular intervals into the Cut for the purpose of furnishing current to be used in exploding fuses. There are both advantages and disadvantages to be considered in connection with this plan, but neither cost nor convenience will be allowed to weigh against the installation of a high-power electric line, if it is decided that the safety of the men at work in the Cut would be increased by the use of such a current in exploding the dynamite.

After the ideas condensed in the above had been presented to the men by the Division Engineer and the Assistant Division Engineer, the men were asked to give their views. It appeared that the action of the Commission in ordering galvanometers and more drills had anticipated the chief suggestions that the men had to make, and the matter of installing a high-power electric line for use in exploding the dynamite was received with favor. It was suggested that greater care be enjoined on the powder men in keeping their batteries dry, in accounting for all unused dynamite and fuses, and in giving timely warning when a blast is about to be set off or dobying is to be done. It is the custom of the pitmen to take refuge under the dump cars when a doby is about to be made, and attention was called to the carelessness of some of the train crews in not giving sufficient warning when a spoil train is about to start, so as to allow the men who have taken refuge under the cars to crawl out before the train starts. Steam shovel men were warned not to dig out dynamite and to take sufficient time to make sure that material in which they are working is free from unexploded charges. The men were told that their efforts to make big records should not be allowed to jeopardize their own safety and that of the men under them.

It was the concensus of opinion that the greatest danger run by the steam shovel men and their helpers comes from the digging up of unexploded dynamite. It is almost impossible to keep count of the number of holes that explode in a charge of from 20 to 50 holes and the steam shovels not infrequently dig up dynamite that has not exploded. Some question was raised as to the quality of the dynamite, and this was answered by the statement that every shipment of dynamite received by the Commission under its new contract is tested by the United States Testing Bureau, and that it has been uniformly up to the standard contracted for. It is fresh, unlike some of the dynamite used in the Cut a year or more ago. Almost invariably the trouble lies in the fuses, which are so constructed that the platinum bridge

*From the "Canal Record," Nov. 4.

in them which completes the circuit is liable to be broken, and the fuse is thus prevented from exploding, with the result that the dynamite charge is not set off. These fuses are tested before they are shipped from the United States, and are tested again on reaching the Isthmus. Hereafter they will be tested three times before the exploding current is turned into them, and the number of misfires will thus be reduced to a minimum.

CONVERSION OF A CANAL LIFT-LOCK FROM HYDRAULIC TO CABLE OPERATION.

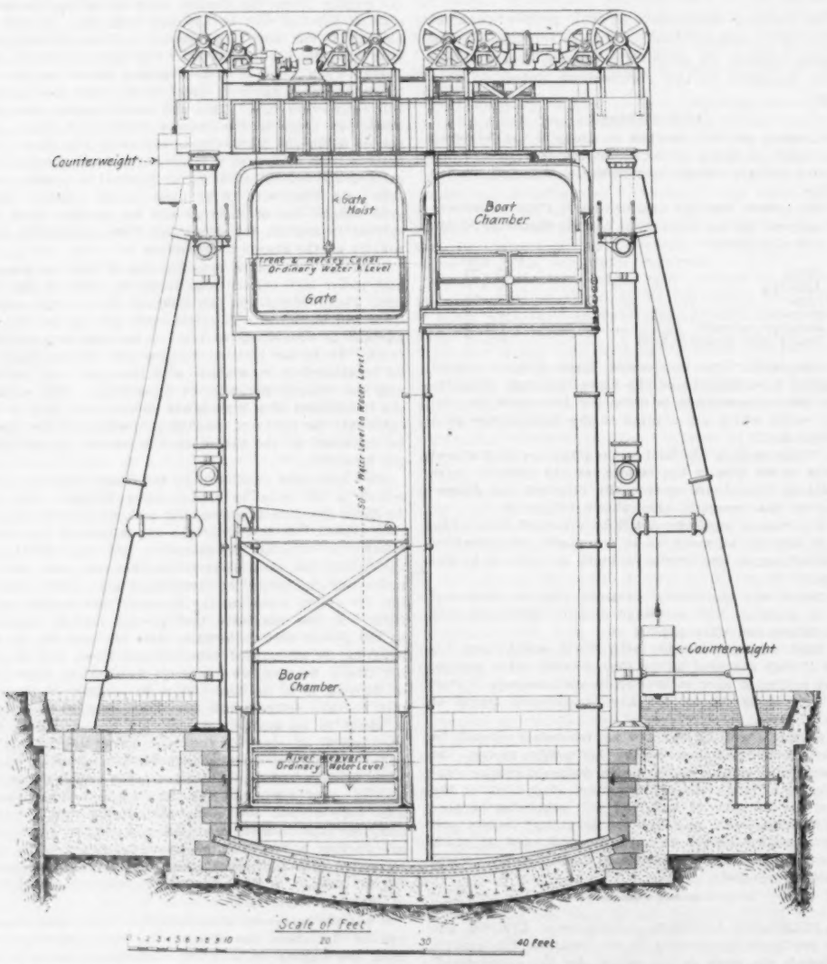
The hydraulic lift-lock or boat-lift at Anderton, England, has been converted into an electrically-operated cable lift, and some particulars of this work will be of interest in connection with the present agitation over canal and waterway development. This lift-lock, which was completed in 1875, was built to connect the Weaver River with the Trent and Mersey Canal. It has two chambers 75 × 15½ ft., carrying 5 ft. of water, and has a vertical movement of 50 ft. 4 ins. It was designed by Sir Edward L. Williams and Mr. Edwin Clark. The lock was described in an article on various types of lift-locks in our issue of April 18, 1895.

As built originally, each of the two chambers was supported by a vertical ram. The ram cylinders were connected in such a way that the chambers were in hydraulic balance. An excess of water was admitted to the upper chamber to overcome the equilibrium, and the final portion of the stroke was completed by means of a 10-HP. engine with hydraulic accumulator. As now altered, each chamber is operated independently by counterweighted cables passing over sheaves on a shaft driven by gearing from an electric motor.

It appears that after about ten years of satisfactory service, the rams showed signs of grooving or scoring, and the roughened surface tended to destroy the packing of the stuffing boxes. Repairs were made from time to time by inserting dove-tailed pieces of copper in the bad places, but in 1896 the grooving was found to be increasing more rapidly, and parts of the rams were so much affected as to cause the engineers some anxiety. It was then found that the canal water, being impregnated with chemicals, set up an electrolytic action between the copper and the iron of the rams. Alloys of tin and copper were tried without success, and it was decided to abandon the use of this water.

In 1902, the old boilers had to be abandoned, and an electrically operated pumping plant was substituted for the old steam plant. This effected an important economy. The entire lock apparatus was in need of extensive repairs, however, and in 1904 plans were prepared by Mr. Saner, the engineer, for substituting the cable system for the hydraulic system. The project was approved by the late Sir Benjamin Baker, as Consulting Engineer, and the details were then worked out. The orders for the work were given in 1906.

The first operations were to build the necessary submerged work, including a dry dock to receive the chambers at the lower, or river, level. All this was done in 1906. Traffic was necessarily stopped during part of this work, the stoppages being from April 12 to 30 and from Aug. 4 to 13. The erection of the new superstructure and machinery was then carried on without further interference with traffic until early in 1908, when the cables had to be connected to the boat chambers. This was done between April 16 and May 5, on which latter date one of the chambers was ready for operation. The second chamber was put in operation in July.



SECTIONAL ELEVATION OF THE LIFT-LOCK AT ANDERTON, ENGLAND, AS NOW ARRANGED FOR OPERATION BY CABLES INSTEAD OF BY HYDRAULIC RAMS.

The weight of each chamber (with water) is 252 tons. This is counterbalanced by 36 groups of cast-iron weights; each group weighs 7 tons and is carried by an independent cable which passes over a 6-ft. sheave. The cables are attached to the sides of the chamber so that there are two rows of sheaves, along the top of the superstructure. Midway between these rows of sheaves is a longitudinal shaft driven by worm gearing from an electric motor. Bevel gears on this shaft drive two cross shafts, each of which has two bevel pinions; these gear with bevel wheels on two longitudinal shafts parallel with the central shaft. On these two shafts are 12-in. pinions gearing with 6-ft. spur wheels, on the shafts of the cable pulleys. The general arrangement is shown by the sectional elevation given herewith.

The movements of the end gates and of the chambers are all regulated from the operating house by means of electric controllers. The foregoing description is condensed from an article in the "Engineer" (London) of July 24, from which also our illustration is reproduced.

THE FEDERAL FOREST ADMINISTRATION is to be radically altered by the division of the forest reserves into six districts, each of which is to be in direct charge of district officers, who will have authority to carry on all ordinary work without direction from the main headquarters at Washington. The work at district headquarters will be distributed among four offices, Operation, Grazing, Silviculture and Products, each equipped with men of special training for the work of their office.

The Office of Operation will be charged with responsibility for the protection of National Forests, for the building of roads, trails, and other permanent improvements upon them; for the organization of the force on National Forests, and with the supervision of all business relating to the special use of National Forest resources. The Office of Silviculture will have supervision of the free use and sale of timber from National Forests, forest planting upon them, and will conduct forest studies on National Forests as well as in cooperation with private owners in the district. The Office of Grazing will supervise grazing business in the district, except for the actual fixing of allowances, periods, and rates, and will make studies looking to the improvement of the forage crop on National Forests. The Office of Products will make both independently and in cooperation with private owners, studies leading to a more profitable use of timber on and off National Forests within the district and to their preservative treatment.

The districts with their respective headquarters and chiefs in charge are as follows:

DISTRICT 1—Including Montana, northeastern Washington, northern Idaho, northern Wyoming, and northwestern South Dakota. Headquarters, Missoula, Mont. W. B. Greeley, District Forester.

DISTRICT 2—Including Colorado, southern Wyoming, South Dakota, northwestern Minnesota, Nebraska, western Kansas, and southeastern Utah. Headquarters, Denver, Colo. Smith Riley, District Forester.

DISTRICT 3—Including Arizona, Arkansas, New Mexico and Oklahoma. Headquarters, Albuquerque, New Mex. A. C. Ringland, District Forester.

DISTRICT 4—Including Utah, southern Idaho, western Wyoming, eastern Nevada, and northwestern Arizona. Headquarters, Ogden, Utah. Clyde Leavitt, District Forester.

DISTRICT 5—Including California and southwestern Nevada. Headquarters, San Francisco, Cal. F. E. Olmsted, District Forester.

DISTRICT 6—Including Washington, Oregon, a small portion of northern California and Alaska. Headquarters, Portland, Oregon. E. T. Allen, District Forester.

PAINTING COUNTRY HIGHWAY BRIDGES.—It is the exception rather than the rule to see steel highway bridges which have been sufficiently protected by paint to keep the steel from rusting. The steel bridges throughout the state show all degrees of rust, from mere first signs to almost complete destruction. We have found part of the steel of a small bridge rusted completely through in 12 years. On many of the bridges which have been examined it was found that in places the effective thickness of the metal was reduced between 25 and 50% by rust.

It goes without saying that steel bridges should be protected from rust as thoroughly as possible. How often should steel bridges be painted, is a question often asked. The only answer to give to this question is that they should be painted as often as the steel shows signs of rust. It does not pay to use cheap, inferior paint, and it does not pay to apply the paint on a surface which has not been thoroughly cleaned of all scale, rust, old paint, grease and dirt.—From the annual report of the Illinois Highway Commission; A. N. Johnson, State Highway Engineer, Springfield, Ill.

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The industrious sensation-mongers of the daily press have been busy the past week with the Gatun dam. One headline reads: "Chagres River is Plunging through 60-ft. gap in Isthmian Wall. Engineers Face Problem."

In contrast with this lurid picture we venture to present the prosaic facts. These are in substance that the Gatun dam itself is not yet built. As the photograph in this issue shows, preliminary excavation for the spillway is well advanced. Besides this, the rock excavated from the Gatun lock site has been dumped in a long pile along the south or landward side of the dam site. This rock pile will serve as a protection to the dam itself from floods in the Chagres during construction and will help to shield it from wave action and to support the slope on the lake side after completion. These rocks have been simply dumped in a pile at random and left to settle through the mud to a solid bearing. The recent heavy rainfall on the Isthmus—28 ins. in a single month—with resulting high water in the Chagres has softened the mud under this rock pile and consequently the settlement during recent weeks has been considerable. The more it settles, the more rock from the Gatun lock pits can be disposed of on this pile.

The American public has vastly more need to worry over the slough of sensational yellow journalism into which its daily newspapers are sinking than over any sinking of the much maligned Gatun dam.

The contrast between the accident rates in the coal mines of the United States and in those of Great Britain has often been referred to in these columns. The report of the U. S. Geological Survey for 1907 shows a total of 3,125 deaths in the coal mines of this country, and a rate of fatal accidents per thousand employees of 4.86. The corresponding figures for the United Kingdom, as published in "The Colliery Guardian" for Sept. 25, 1908, are 1,279 deaths and 1.46 deaths per thousand men employed. A comparison may also be made of the ratio of fatal accidents to the tonnage produced. The number of tons mined for each life lost was 145,471 for the United States and 226,757 for the United Kingdom.

The contrast is not so great here because the output of coal per man employed is much larger in the United States. The actual figures were: United States, average tons mined per employee, 707; Great Britain, average tons mined per employee, 332. The reasons for the larger output per employee in this country are first the greater use of machinery here, labor being much more highly paid. In the second place, American coal workings are new compared with those of Great Britain, and the workings are therefore nearer the service, requiring less labor to produce a given output.

The treatment of the surface of concrete sidewalks with acid is briefly described elsewhere in this issue, as practised in Chicago. So far as we can see, the process involves such expense and possible risk of injury that it could hardly be commended for general use. If it is desirable to roughen the surface of a concrete walk and relieve the glare, as is doubtless the case in many places, it would seem better to sprinkle the surface with coarse sand or quarry dust after the floating is done and before the cement has set. A sprinkling of this sort could be applied quite liberally, and the surplus afterward brushed off. It would give exactly the same result of a projecting aggregate as the acid treatment, and would be free from the numerous objections to the latter, as, for example, the injury to the future growth of the grass alongside the walks.

Firebrick arches for locomotive fireboxes are almost as old as the locomotive itself. No engineer who understands the elementary principles of combustion has ever denied the advantage of the brick arch as a means of securing perfect combustion and reducing smoke. Yet because there is some expense and bother in maintaining brick arches they have been discarded in many cases.

In a paper read on Nov. 13 before the Central Railway Club, Mr. Geo. Wagstaff urged that the brick arch ought to be applied not only as a means of saving in fuel consumption but to increase the capacity of the locomotive boiler. Mr. Wagstaff says:

> The non-use of the brick arch means the practical throwing away of a large amount of valuable power. The arch is recognized as the most efficient device for reducing the quantity of sparks thrown from the stack, and, on this account, it becomes directly valuable as a fuel saver. It increases the length of the flame-way, and the finer fuel, when lifted from the grate, is baffled by the arch, and is consumed, instead of passing directly to the tubes and out of the stack in the form of sparks. It causes more equal distribution of the draft over the grate and thus improves the furnace action. Its function in the firebox being that of a mixer and baffle, bringing about a more complete mingling of the gases, and, thereby aiding combustion resulting in a higher temperature, and the production of a smaller proportion of carbonic oxide.

In proof of these claims Mr. Wagstaff cites the tests made by the Pennsylvania R. R. at the St. Louis Exposition in 1904. Here two consolidation locomotives were tested, one with the brick arch and one without. The test showed that the firebox with the brick arch maintained over 200° higher temperature on the average and lost only 2.09% on account of imperfect combustion, while the firebox without the brick arch lost 16⅛%. In addition the cinders thrown from the stack were much less with the brick arch.

If additional evidence were needed to prove the advantages of the brick arch it is probable that it could be obtained by careful study of European locomotive practice. That this is far ahead of American with respect to freedom from smoke and high evaporation per pound of coal is pretty well known. While part of the difference is due to better work on the part of the fireman, it is likely that the bulk of it is due to intelligent use of the brick arch.

Even if the brick arch saved no coal and gave no added capacity to the boiler, it would still be well worth while to use it as an aid to smoke prevention. The railways of the country must face the fact that the change to electric motive power of the passenger roads entering New York City—a change made compulsory there because of the entrance through tunnels—is going to be followed by demands from twenty other cities that similar changes be made for their benefit. Such changes may even be forced by legislative enactment. Experience at New York has shown that the change of motive power from steam to electricity is enormously costly, and involves of necessity heavy additions to the capital account. This is not alone an injury to the railways but it eventually forms a burden on the general public, on shippers and travelers, whose freights and fares must eventually bear the burden of all improvements and changes.

But when we sift down the argument for a change to electric motive power we find the chief indictment against the steam locomotive to be the cloud of black smoke that it pours forth. It follows, therefore, that if brick arches with careful firing can prevent the smoke, then brick arches by all means ought to be used. Delaying the evil day of change to electricity is even more important to the railway stockholders than economy in coal consumption.

THE RELATION OF TEMPERATURE TO THE REMOVAL OF CONCRETE FORMS.

Recently we received a letter from a prominent contractor in which note was made of the comparative scarcity of any data upon the effect of the temperature of the air upon the setting time of Portland cement mortar and concrete. Our correspondent said that as the premature removal of forms is the most fruitful source of accident in concrete work and as it is fairly well established that a lower enveloping temperature means a longer setting period, it would seem prudent for some one to inaugurate a series of tests to determine, if possible, the relation between temperature and time of set, and to use the data so acquired in a specification which would connect the time of removal with the temperature.

At first glance we thought that there had been an ample sufficiency of such tests published, but upon investigation it was found that by far the larger part of such work was with varying temperatures of the ingredients of the concrete—with a view toward determining the effect of frozen materials—and but few tests looked into the temperature of the setting medium. Such tests as have been published are not in the form to aid much in regulating procedure in actual work, and, though it is quite desirable that the time of removal should have a relation to the temperature, there is at present considerable difficulty in formulating any definite rule.

In the first place, as quoted from an eminent authority in the article on cement testing on another page of this issue, "different cements are differently influenced by alteration in temperature, and it is scarcely possible to deduce a general law for even one class of cements." An observation of the abstracted table given in this same quoted article will confirm this opinion at least for the moderate range of 70° to 90° F., for it will show that while high temperature cannot change a quick-setting cement to a slow-setting, yet the rise in temperature does not necessarily quicken the setting period of a slow-setting cement. In spite of this opinion, however, it is sufficiently true for the less refined construction practice to state, as a rule, that the higher the temperature the quicker the set; but the relation between the two is not at all constant or sure. For this latter reason any laboratory tests from which working rules are to be deduced must be considered rather freely as the basis of a general supposition rather than absolute fact.

But most important in regard to these tests is the fact that most of those which have been published are needle tests on initial and final sets, which data cannot correctly be used in assigning periods for form removal because there are no comparable units by which the actual working conditions may be gaged. For instance, one of these tests shows that a certain concrete will reach its Vicat needle final set in 10 mins. at 80° F. and in 8 hrs. at 35° F. Suppose it is deemed safe to remove the forms at the former temperature in 48 hrs., by what means could the experimental data be applied to the removal

at a temperature of 35° F? Surely, it would not be necessary to use the same direct ratio for time intervals in removal and in set, for this would require the forms to be kept in place 96 days in the lower temperature. This is of course absurd, for other tests show that with time all concretes, even at low temperatures, increase in strength and that occasional rises in heat greatly accelerate the strengthening process.

Now, the rapidity with which cement sets to the limit of hardness measurable by the ordinary needle test is no certain indication of its strength, that is, the ratio of so-called final setting time of two cements—intervals which will range between one and eight hours, say—is not necessarily the same as the ratio of strengths of the two same cements at the end of 48 hrs. As the time of removing forms is dependent upon the strength of the concrete, then the proper test to make in the investigation proposed is the effect of temperature on strength, either tensile or compressive, as convenience rules, in a given time.

For instance, it may be found by testing in the ordinary temperature of 70° F. that a certain concrete reaches a compressive unit value of 1,500 lbs. in 48 hrs., a strength deemed sufficient for the safe removal of the forms. It would then seem that the proper way to determine the time of removal at other temperatures would be to ascertain by tests the time necessary for the compressive unit strength to reach 1,500 lbs. at each of the desired temperatures, or at least, by means of several specimens from the same mix, determine a strength-time curve from which can be computed the time when a 1,500-lb. strength may be expected. It may be found, then, that for fixed conditions of mix and material there can be deduced some relation between strength and temperature which can be used in construction. Such a relation need not be rigid because the large margin of safety allowed in the assumption of the proper unit value will take care of any but the most unexpected variations from the deduced rule. It is to be hoped that some such tests will be undertaken, for the establishment of some scientific basis for form removal will add to the fast growing rational design and construction in concrete.

LETTERS TO THE EDITOR.

The Ohio River Reservoir Project Again.

Sir: The criticism of my former paper on this subject made by Mr. M. O. Leighton in the Engineering News of Nov. 5, 1908, deserves some reply, though it appears that he is not yet through with his "thorough and judicial review." Some of my errors and inconsistencies still remain for later treatment.

It would probably be tedious and unprofitable to follow his example and consider in detail all of the points brought out in his long discussion of my paper, and it will doubtless suffice in a number of instances to merely indicate features that invite criticism, such as the following:

His curious illustration of foreign opinion as to practicability of reservoirs by reference to certain rivers where they would have been used if it had been possible.

His objection to any reflection on the "engineering proficiency" displayed in a majority vote of an Inland Waterways Commission composed of four lawyers, one farmer, one forester, one ethnologist, and two engineers.

His novel idea of the value of the "perspective" enjoyed by an outsider as compared with the knowledge of a worker in the field to be investigated. (Some striking illustrations could be given of absurd errors made in this connection by persons of great ability, whose "perspective," however, failed to compensate for lack of knowledge).

His remarks about "the feudal system of river improvement" and the "royal province of river engineering," (though he contradicts my similar use of the term "river engineer"), and his apparent ignorance of the large number of able civilian engineers who are now or have at some time been associated with the Corps of Engineers in work on navigable rivers, and who therefore occupy a position of some advantage in judging the conclusions about navigation problems reached by those who "have been allowed to work on non-navigable rivers."

His implication that navigation works hitherto prosecuted have been detrimental to other interests, and his proposition that they cannot be properly developed without awaiting a solution of the whole problem of the conservation of water resources, requiring a co-operation, hitherto unattempted, of "Federal agencies, states, municipalities, communities, corporations, and individuals."

His strange reference to my attempt "to discredit the idea without more information on the subject than the original author had in his possession."

His apparent contempt for the wholesome fear that every engineer should entertain for the uncertain elements affecting an engineering structure, combined with his suggestion of earth and rock fill dams for structures 200 ft. and more in height.

His amusement over the hoary absurdity involved in my remark about the unsanitary conditions incident to large fluctuations in water level of reservoirs.

His confessed inability to see any difference in principle between the use of National funds to protect private property from flood damage and their use to provide public waterways for transportation purposes.

Such features hardly require further comment. On the other hand, his remarks about the Federal income from water power deserve a little further attention, as this question of water power is one of the main elements of the project. He now says in substance that he never intended to indicate a probable Government income of $20 per horsepower-year, and he is quite satisfied with my maximum figure of $5. But, if he had such views, he should have been more careful in the choice of his language. His statements on this feature of the system naturally conveyed the impression that an income of $20 per horsepower-year could reasonably be expected. Moreover, this impression was confirmed by some of his remarks elsewhere. In the report prepared under his direction on "The Relation of the Southern Appalachian Mountains to Inland Water Navigation," p. 29, the Youghiogheny River is spoken of as follows:

"There is presented here a condition identical with that of the Monongahela before canalization, but here there is the added advantage that the proposed Youghiogheny system is a new one and no mistake need be made. The way to utilize the available power along this stream is to develop coincidently with canalization the conservation system outlined in Table 17 and to provide that the upland area shall be set apart as a reserve so that the natural conditions of forestation will not be destroyed. . . . There would be insured a discharge of at least 1,500 cu. ft. per second throughout the year at the various dams proposed under the slackwater system. This amount of water, allowing for necessary loss by leakage and lockage, would insure the production of 4,100 HP., which would at times be greatly exceeded. Figuring on an average rental of $20 per HP. per year (it would be considerably greater in this situation), the total income would be $82,000, which represents an interest of 3% on about $2,700,000. This provides a specific illustration of the policy that should prevail in connection with improvements for inland navigation. Under it water and power now wasted would be put to productive use and the cost of the canalization and conservation would be returned, in marked contrast to the present policy, which involves a constant drain on the National Treasury."

This statement certainly seems very plain and indicates, apparently, that Mr. Leighton expected the Government to receive at least $20 per horsepower-year.

Moreover, his statement is particularly interesting as illustrating what he considers the correct policy of river improvement in comparison with the crude methods hitherto in vogue. As he has "been allowed to work on non-navigable rivers" and has "learned to draw conclusions" therefrom about navigable rivers, and, moreover, as he has been indicated in an official report to Congress as the most competent man whose services could be secured to discuss the relation of the Southern Appalachian Mountains to inland water navigation, it is natural that his specific illustration of the right way to improve navigation should receive some attention. Upon examination it appears, indeed, that he does not discard the method of canalization hitherto proposed for the river, as one might expect after his severe arraignment of similar work on the Monongahela, and more especially in view of his statement before the Committee on Agriculture that his policy would save the money the Government "is now wasting on dredging" and "needlessly putting in for locks and dams." On the contrary, he adopts canalization and simply adds five storage reservoirs and sets aside the uplands as a forest reserve. Thus he transforms a moribund, defective policy into one of correct and vital attributes.

Now the aggregate capacity of these reservoirs is 31,750 million cubic feet. They would probably cost at least $18,000,000, as my estimate of cost for the largest one, including about two-thirds of the total capacity, ran over $12,000,000. Disregarding the cost of the forest reserve and the annual charges for operation and maintenance of these reservoirs, we find that the added features involve at least an annual interest charge, at 3%, of $540,000. It is obvious that his estimated annual revenue of $82,000, which is now reduced to $20,500 by computing on the new basis of $5 per HP., would leave a considerable deficiency. This may seem like a good proposition from Mr. Leighton's "perspective," but others will doubtless be skeptical.

It is obvious, of course, that to utilize the fall of navigable rivers for power purposes, it is necessary to build locks and dams and power plants. But the locks and dams alone are generally sufficient for navigation purposes. Whether the power plants and reservoirs are advisable in such cases would therefore [illegible] to be determined mainly on considerations apart [illegible] navigation interests.

Mr. Leighton devotes a couple of pages [illegible]owing that the various objections or disadvantages [illegible]tioned in the first part of my paper are by no means [illegible]perable, nor in some cases even important. If he [illegible] my paper carefully he must have noticed that I [illegible]ssed them myself in a sentence, as not controlling [illegible]ors, when I said:

"Notwithstanding all these considerations that tend to lessen the estimates of value [illegible] however, be derived from the system, there can [illegible]benefits to that there are such benefits of great [illegible]question the system should be built if it can be done [illegible]ance, and able cost."

This statement, moreover, seems to have [illegible]aped the attention of the editor, also, when he said that I was "as much against storage as Mr. Leighton [illegible] in favor of it." It would seem that my statement should satisfy almost anyone. What more, indeed, could [illegible] properly say in passing judgment upon the project? No sane man would wish to overlook the undesirable features of any work he is asked to undertake. It seemed to me that the public had been given only a one-sided view that was therefore misleading, and I wished to call attention to these points that had been more or less overlooked and yet must be considered. From the nature of the case I was obliged to lay emphasis upon difficulties that lay in the way of the system.

To my mind the controlling feature, aside from the legal or constitutional questions involved, is the cost of the system, and I therefore addressed myself mainly to that aspect of the matter. It would be ridiculous, of course, to suppose that the very limited examination of the subject presented by me was considered conclusive. The problem is one of enormous magnitude and well worthy of further investigation so that our water resources may be utilized to best advantage. I recognize the benefits of the system and shall be delighted if they can be realized. I fear, however, that the cost will be found excessive and the project impracticable—at least such information as I have been able to collect points that way—and that in the meantime navigation and other important interests will be allowed to suffer in expectation of assistance that may never be realized.

Now it was on the vital question of cost that Mr. Leighton's paper seemed to me to be specially defective. If he had stated, what he must have known, that the cost of 88% of the total capacity of his system was computed upon the cost of the Upper Mississippi reservoirs, together with the estimated costs of some irrigation projects in the arid regions of the West, the public would have been in a better position to judge the adequacy of his estimates. Yet he apparently regarded the estimates as fairly satisfactory. In testimony before the House Congressional Committee on Agriculture he stated unreservedly that the cost of the system would be about $125,000,000. When Captain Conner criticised his estimate, he replied by calling attention to the Croton, Wachusett and Ashokan dams and "many others the cost of which was or will be excessive," as having been used in determining his unit costs. In view of the facts these statements seem misleading, and yet he says his "basis of cost estimate was admittedly poor, but the defects bristled conspicuously and therefore it was fair."

Quite unjustly he tries to create the impression that I deliberately selected certain sites that would give abnormal and excessive esimates, and then attempted to deceive the public by extending such estimates to the entire system. As a matter of fact, the six largest reservoirs in the Monongahela Basin, all, indeed, of the large capacity under consideration, and comprising two-thirds of the proposed storage capacity of that drainage area, were selected by Captain Adams for examination without prior knowledge of what the result would be, and simply because it was felt that such an examination would afford a reasonable test of Mr. Leighton's figures. Moreover, the basis of the estimate was fully set forth, so that every one should have an opportunity to judge for himself. Yet Mr. Leighton pronounces these reservoirs, forming an important part of the system he proposes, to be far less representative than those used by him.

His method of criticism is illustrated by the fact that while in only one of the six cases were the coal damages of any considerable amount, yet he says that I "sent Captain Adams into the most valuable mineral region in the Ohio Valley, and, with fine discrimination selected the basins in which there are workable coal deposits of great value," etc., and that in applying my unit costs to the entire system I have placed myself "in the position of assuming that beneath practically all of the reservoir sites in Ohio, Indiana, Kentucky, Tennessee, and other states covered in the plan, there are immense deposits of coal." In view of such remarks and of the circumstances of his own estimate, his characterization of my estimate as being specious and unfair seems peculiarly inappropriate.

It may assist, in considering the question of reasonable unit costs for a preliminary estimate, in advance of detailed investigation, to invite attention to the basis

proposed by the late J. J. R. Croes for the Croton drainage area as used by Mr. C. C. Vermeule in his very able report on the Water Supply of New Jersey when estimating the cost of water storage for power development. This is $170 per million gallons of reservoir capacity. It is true that while Mr. Vermeule uses this figure, he considers it a high allowance. Now suppose we take only one-half this estimate and use a unit cost of $85 per million gallons. This corresponds to about $630 per million cubic feet, and applying this to the Ohio River system we get a total estimate of about $1,350,000,000, or over ten times Mr. Leighton's estimate.

When proper deductions are made from over-sanguine estimates of benefits, and reasonably adequate estimates of cost are considered, it seems very doubtful whether the system will be deemed financially practicable under existing conditions, and this great project may have to take its place, at least for a time, among similar rejected schemes of the past that held forth alluring prospects incapable of realization.

H. C. Newcomer,
Major, Corps of Engineers, U. S. A.
U. S. Engineer Office, Pittsburg, Pa., Nov. 25, 1908.

High Unit-Stresses in Bridge Design.

Sir: I wish to compliment Engineering News on their timely editorial "Concerning High Unit-Stresses in Steel Bridge Design." It might be supposed that the report of the Royal Commission with regard to the Quebec Bridge and the reports of Messrs. Boller & Hodge and Prof. Burr regarding the Blackwell's Island Bridge would be sufficient warning. I fear, however, that the tendency to follow the precedent of high unit-stresses, and the great saving in dead weight which can be effected by their use in long span bridges, will result in their continued use unless the profession unmistakably condemns the practice.

Like other thoughtful American bridge engineers, I feel and regret the stigma which has been placed upon us as a class, and I am very glad that before any public question was raised as to the Quebec and Blackwell's Island bridges, I had registered an opinion as to lattice bars, in the Lehigh Quarterly of June 18, 1891, and an opinion as to "Proportioning Steel Railway Bridge Members" in the proceedings of the Engineers' Society of Western Pennsylvania for July, 1907, and in an article on the same subject sent to Engineering News prior to the Quebec Bridge failure. In this article, after making proper allowance for impact and for possible future increase in loading, I recommended 16,000 lbs. per sq. in. as a unit-stress for ordinary structural steel when designing, and 20,000 lbs. when examining into the safety of an existing structure.

Yours truly, Henry S. Prichard.
1526 Frick Bldg., Pittsburg, Pa., Nov. 23, 1908.

Forests and Stream Flow.

Sir: I concur in the views expressed by Prof. Robert Fletcher in his communication on "Forests and Stream Flow in New England," appearing in your issue of Nov. 19.

My memory of conditions obtaining in the region between Boston and the Canada line, covers over 40 years and corroborates the statements made by Prof. Fletcher. I was "brought up" in a region where there were many tracts of so-called primeval forest. One that I remember of about 1,000 acres was said to have never had a tree felled by an axe within its limits. The growth there was mostly spruce. Other tracts from 10 to 100 acres or more were common where the growth was mostly hard woods. I refer here to the highlands of southwestern New Hampshire. My impression is that not only the spring freshets but those due to summer rains were more disastrous on the small streams at that time than they are now. Forest growth, without doubt, prevents soil wash; but the vaunted "mould" is a negligible quantity on the stony hillsides of New England.

The run-off conditions differ between regions of heavy snow and those where snow is of little importance. I have seen instances of spring floods where Col. Chittenden's reasoning certainly held. Moreover in a forested stream, jams from ice or driftwood are common and these cause the worst flood conditions. Examination of the valleys of streams in northern New Hampshire has convinced me that floods in ancient times, long before the region was settled, were much more severe than now. Remains of old jams can be made out that have actually turned the course of the stream in a way not conceivable at present.

On the other hand forests conserve the flow by retarding evaporation on reaches of streams where the fall is rapid over a rocky bed. It is heartrending to one who wants water to run a mill, to observe the tremendous loss that occurs in a hot clear day on a long rapid above him where the stream bed is paved with cobbles and bowlders projecting above the water with their tops alternately wet by the splashing water and dry by the scorching sun. If forested, the overhanging trees and water-loving bushes shade much of the width of the stream; but if cleared the full force of the sun gets in its pumping effect. It can be said that proper conservation and regulation will clear up these rocky channels and lead the water in deeper, smoother channels and thus save the water for economic use and I believe that this will some day be done; but Nature's way is by the forest.

Col. Chittenden's strictures on the "visionary features of the reservoir propaganda" seem to me to be sound and well stated; but isn't his trend towards growing forests on our rich lowlands equally absurd? Forests are needed on our thin-soiled precipitous hillsides to prevent wash; many varieties of trees flourish on northerly slopes which are not well adapted to cultivated crops in our northern climate; and our winter snows make timber accessible on rocky hills where summer transportation for cultivation is impracticable. Hence let us encourage forest growing on our hills and mountains and correct our streams through the open land.

Yours truly,
J. P. Snow, Bridge Engr. B. & M. R. R.
Boston, Mass., Nov. 23, 1908.

Action of Alkali Waters on Concrete; Crystallization as the Cause.

Sir: Recent articles in the columns of your magazine regarding the effect of sea water on concrete indicate conditions somewhat analogous to those found in portions of the semi-arid northwestern states, where the soil is heavily charged with the so-called "alkali salts."

It has been found upon several of the Reclamation projects that first-class concrete suffers more or less serious disintegration when subjected to successive wettings with strong alkaline water.

Culverts which are perfectly sound and hard above the ordinary groundwater level, or where constantly submerged, will show progressive disintegration from the surface inwards at points on the end walls, or near shrinkage cracks in the floor, where seepage water is evaporating. The surface at these points is flaked off by the disruptive effect of crystals which result from the evaporation of the water, the effect being almost identical with that caused by freezing. Freezing, however, is not a factor in this case, as portions of cellar walls entirely below the frost line show similar action.

This matter is one of great importance to the Reclamation Service and to others building concrete works under similar conditions, in that disintegration does not depend upon percolating water passing through the concrete, but originates on exposed surfaces which are alternately wet and dry, and cannot be successfully withstood even by a granolithic finish.

Portions of some culverts under the writer's observation probably will have to be renewed within ten years, by which time it is hoped that chemists of the various prominent cement companies and of Government Departments, who are now studying the problem, may have discovered some preventive or remedial measures.

Yours very truly,
W. W. Patch,
Constructing Engineer, U. S. Reclamation Service.
Orman, S. D., Nov. 10, 1908.

[This destructive action of alkali waters was discussed in our columns in the issues of July 2, 1908, p. 25, July 23, 1908, pp. 99, 101. The above letter merely adds confirmatory testimony to that already given.—Ed.]

Teaching "Horse Sense."

Sir: With much interest I have just read the editorial note in your issue of Nov. 12, on the teaching of "horse-sense."

As professor of machine design at the School of Applied Science, Carnegie Technical School, I give lectures every week on the following subjects: freehand sketching and machine construction, descriptive geometry, mechanism, elements of machine design, machine design, shop management.

The first and last of these courses I suggested as necessary to all engineers, because they distinctly tend to develop that quality of mind which is sometimes called "horse-sense," or common sense, and which I like to define as meaning "sense of values." A man who does not know a big thing from a little one generally accomplishes little, using up his time and his energies in an unprofitable struggle with the things that are trivial. We say that such a man lacks common sense.

Now, although I do not think it possible to teach "horse sense" in the *abstract*, I do think that an engineering school should give instruction in those subjects that tend to develop a "sense of values." Freehand sketching, by which I mean the making of mechanical drawings *freehand*, using machines themselves, and not drawings, to draw from, most certainly does exercise and strengthen the sense of proportion. I believe that as soon as possible after a young man has made up his mind to be an engineer he should become intimately acquainted with a few well designed machines. Assuming, as is often the case, that the young man has suffered a course in geometrical and so-called mechanical drawing in his earlier schooling, under the guidance of one of the fair sex, he already knows many things about drawing that are not so, and should therefore be put to work, immediately, drawing things that really *are*, drawing them in a way that will develop his sense of proportion and at the same time help him to make the personal acquaintance of real machinery. There are comparatively few men who are color blind; there are still fewer who are "form blind." My own experience proves, without a shadow of doubt, that practically every student can learn to make a freehand sketch that tells the story. Only a few are born with the artistic temperament that endeavors to express itself through the point of the pen or pencil but practically all can learn to see things as they really are and therefore to judge proportions and to tell the story by means of a freehand drawing.

With regard to the "qualification for the greatest success": I believe that a course in engineering should include suggestive lectures on the management of men and on getting work done systematically. The following is a general synopsis of a course of lectures given to the Seniors in the School of Applied Science:

(1) The part the mechanical drawing should play.
(2) General design of a model plant; division into departments.
(3) Organization of a manufacturing concern; appointment of employees (each student is appointed to a position in the concern, and in recitation is called by the name of the position he fills).
(4) Who's who, and subdivision of authority.
(5) The routine of work, from receipt of order from customer to shipment of product; taken from the system actually in use in a factory where machines are manufactured with interchangeable parts as far as is economical.
(6) The measuring and recording of time taken, by "operation".
(7) The use of production data sheets as a modern development.
(8) Distribution of plant charges.
(9) Productive and non-productive labor.
(10) Hourly burden.
(11) Depreciation of the plant.
(12) Remuneration; day work; piece work; the premium plan; the task plan.
(13) Work that can best be done by committees.
(14) System and how to prevent it from deteriorating into red tape.
(15) The designing of printed forms.
(16) The preparation and writing of specifications.
(17) Records and indexing.
(18) Production; time saving methods; automatic machinery; jigs and fixtures.
(19) The human element in the management of men.
(20) The laying out of a shop, and of a drafting room.

The students have taken great interest in this course of lectures and have done excellent work in connection with it.

There are today so many sides to the work of the engineer, in addition to that of designing, that it does seem to me advisable to give the student some basis for operating along these other lines. These other phases of his work are not only interesting, but useful; there is a demand for men who can not only design a machine that will work, but also one that can be sold at a profit. There is also a demand for engineers who can look after the production end of the business scientifically; others are wanted to help to sell the product of the factory, whatever that may be.

In conclusion I should like to say that I think we too often expect a man to exhibit common sense about something of which he does not even know the rudimentary principles. This is expecting too much. A man who has been trained to design machinery theoretically, without regard to methods of production and modern shop practice, may have plenty of common sense of a certain kind, but he will certainly have to be assisted by a man who has the kind of common sense that he lacks, if the machine is to be a marketable quantity.

Yours very truly,
George H. Follows.
5643 Woodmont St., Pittsburg, Pa., Nov. 18, 1908.

The Cape Cod Canal Will Not Freeze Up in Winter.

Sir: The otherwise admirable editorial in Engineering News of Nov. 26, on p. 549, about Atlantic Deep Waterways, is marred by the statement: "It must be remembered that both these canals would be put out of service by ice during the winter months, when navigation around Cape Cod is most hazardous."

Now the fact is that there is an enormous difference between the two projects referred to—the planned New York, Brockton & Boston Canal, and a properly constructed sea-level canal at Sandwich. While the first would freeze up every winter the second named would stay open.

The first named would be a *fresh water canal*, containing stagnant fresh water, or else fresh water ice;

whereas the second named would be a *sea-water canal*, with the water constantly flowing back and forth and as constantly *free* of ice.

Palpably no canal on that general route is fit to be built, that would freeze up every winter; and it may well be, that to cloud the issue, and bring discredit on any proposed New York to Boston maritime canal, the Brockton canal was originally proposed, and agitation for it is kept alive.

Anybody, who like the writer has been working in favor of an efficient New York and Boston maritime canal these 35 years, has seen more than one similar device of the enemy—the holders of the sea-borne passenger and freight monopoly between New York and Boston—put in motion, and will not be surprised at any such tactics. But it is a little too much to see Engineering News unconsciously playing into the hands of this interest.

Very truly yours,
Clemens Herschel.

No. 2 Wall St., New York, Nov. 28, 1908.

Notes and Queries.

In the notes on "Wooden and Steel Ties" in our issue of Nov. 19 (page 566) a typographical error gave Mr. Meade's opinion as being that "some" foreign designs of metal ties are suitable for use on American railways. As a matter of fact, Mr. Meade's opinion was that "none" of the ties were suitable for American railways.

SHOP-MADE REINFORCED-CONCRETE PILES.

By L. J. MENSCH,* M. Am. Soc. C. E.

The new power station of the Pacific Gas and Electric Co., at the intersection of First and Jefferson Sts., Oakland, Cal., is situated only a few hundred feet from the Oakland estuary, at a site where test borings showed hard yellow clay mixed with sand (called sandstone by the local dredging concerns on account of the great difficulty in working) overlaid by 8 to 12 ft. of mud and cinder fill. Inasmuch as the low water level is about 10 ft. below the ground the use of wooden piles was out of the question, for the point where they had to be cut off nearly coincided with the yellow clay. Hence, the foundation for the power-house proper, the boilers and the turbine had either to be carried down to the yellow clay, necessitating expensive trench work and costly pumping and a great waste of masonry, or concrete piles had to be adopted.

In the face of the local prejudice and against the advice of local contractors, who maintained that, as at many places around the bay great difficulties are experienecd in driving wooden piles into the yellow clay, it would be impossible to drive concrete piles into such hard ground, the engineers decided to use concrete piling. The writer was employed to make and drive about 190 concrete piles, within two months. Time was of the utmost importance, as the power station had to be ready for use before the heavy winter demand set in.

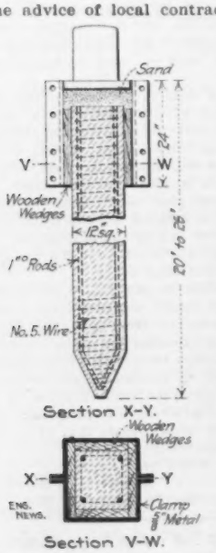


Fig. 1. Reinforced-Concrete Pile Made by L. T. Mensch, San Francisco, Cal.
(Showing also the driving-block at the head of pile.)

The short time in which the piles had to be made and driven required that no chances be taken that any piles be broken either by handling or driving, and it was specified that only the very best of materials which were available in the market should be used. A cement was looked for which gave the best test in the mixture of one part cement to three parts of sand after 28 days. A cement manufactured by White Bros., in London, Eng., was found that showed tests of 450 lbs. per sq. in. in 28 days, although the price per barrel was one dollar higher than the next best brand investigated. A coarse silica sand from Santa Cruz, Cal., and hard crushed limestone, ¼ to 1½-in. in size was used for aggregate.

As shown in Fig. 1 the piles were 12-in. square, from 20 to 26 ft. long and reinforced by four bars 1 in. round, square, twisted or twisted lug bars; in fact any kind of rod, which could be obtained from stock without delay, had to be used. These four bars were tied together by a spiral reinforcement, consisting of No. 5 wire with a 2-in. step.

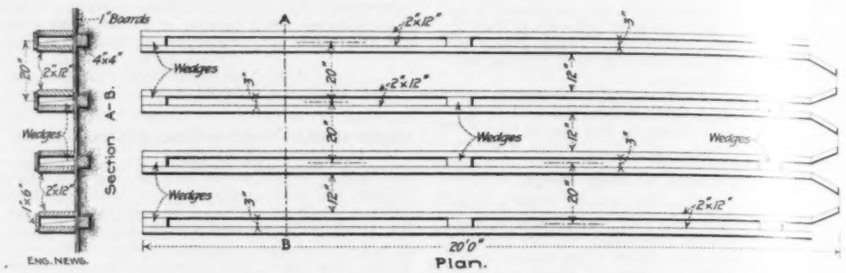


FIG. 2. PLATFORMS ON WHICH REINFORCED-CONCRETE PILES WERE CAST.

The piles were cast horizontally. In order to do this three platforms were built at the writer's yard at East Oakland; one platform 50 × 90 ft., one 25 × 150 ft. and one 24 × 75 ft. They consisted of 4 × 4-in. sleepers spaced 20 ins., c. to c., covered by 1-in. boards. Fig. 2 shows the scheme of the form work. The concrete was machine mixed in the proportion of one part cement to three of aggregate; the consistency was medium wet. The concrete was wheeled in wheelbarrows directly over the forms and poured into the spaces for the piles. The actual concreting took only five days, and it took a gang of 12 to 18 men to assemble the reinforcement. The piles were sprinkled continually for one week after the manufacture and three times daily for another week.

The piles were moved to the power-house after they were about two weeks old, which required a wagon haul of about four miles. They were loaded by means of a gin-pole and a 10-ton differential block on a lumber wagon, which had a 3-in. steel roller fitted into the bed of the wagon behind the rear wheels. Two piles were placed on each wagon. Although the road was rough in many places the piles did not crack in hauling, nor did they crack when rolled off the wagon like a log of lumber, provided the place where they were dumped was not too uneven. A few piles were cracked in this manner, but the cracks closed after the first blow of the hammer while driven, and never gave any trouble.

The piles were driven by a steam hammer, of the heaviest type made, the striking portion of which weighed about 5,500 lbs., and gave about 60 blows per minute. The pile driver frame was 72 ft. high and had a base 42 ft. long. As protection for the top of the piles, iron clamps, as shown in Fig. 1, were used, made of ⅝-in. metal and 24 ins. long. They held the top portion tight by wooden wedges and protected about 6 ins. beyond the pile. This space was filled with sand, and on top of this a 2-in. steel plate connected with a piece of 10-in. shafting was placed in order to fit into the cap of the hammer. After the piles were hoisted into place and alined the hammer was let down on the pile, and after two or three blows the pile [illegible]rated the 8 to 12 ft. of fill and mud very s[illegible]y, during which time, lasting only a few [illegible]nds, the hammering was discontinued. Aft[illegible]s it took only 200 to 250 blows to drive the [illegible]down the full depth. A very peculiar featu[illegible] the driving of these piles was the tenden[illegible] the piles to rise after each blow, but before [illegible] pile came up one-half inch or a little more, [illegible]ceived a new blow from the hammer. As thi[illegible]dency of raising is always observed in quick[illegible] the men employed around the pile driver insisted that there must be quicksand in the ground, which is, however, not the case. Not the least spring was noticeable in the piles while driving. At first the top of the piles were considerably smashed, but after the men got used to the work this was not noticed. The best day's work was 24 piles driven, and the best half-day's work was 18 piles driven. The penetration of the piles while driven into the hard yellow clay was nearly uniformly 1 in. per blow.

The load which the piles were designed for was about 30 tons for the building proper and the boilers, and 25 tons for the turbine. The first pile which was driven was tested to establish the carrying capacity. A load of 43 tons produced a settlement of 3/16-in. after 24 hours, which load, after being increased to 50 tons, produced a settlement of 2½ ins. As all the other piles were driven much harder than the first pile, it is probable that the carrying capacity of these piles is 50 tons. Only one pile, the first pile concreted, broke in driving. This must be ascribed to improper mixing of the first batch out of the mixer. The broken portion showed very imperfect concrete. There is no question that the greatest care must be exercised when manufacturing concrete piles to assure satisfactory results.

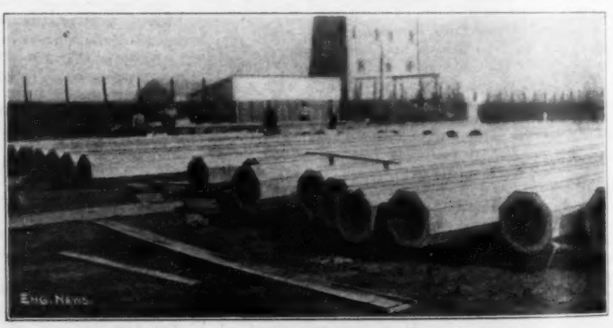


FIG. 3. HOLLOW CONCRETE PILES USED IN THE HARBOR WORK AT SAN FRANCISCO.

Fig. 3 shows a number of other piles recently made by the writer for new sea-wall in the harbor of San Francisco. They are octagonal, 24-in. diameter on the outside with a circular 19-in. inside diameter, and are reinforced longitudinally with twelve ¾-in. bars and circumferentially with a spiral of No. 1 wire with a 3-in. step. The concrete is mixed 1:2. They stand driving surprisingly well; certain of those placed were driven to refusal under a hammer weighing 4,600 lbs. with an 8-ft. drop.

*42 Market St., San Francisco, Cal.

A SYSTEM OF COST AND TIME KEEPING IN USE AT THE COLUMBUS, O., MUNICIPAL ELECTRIC LIGHTING PLANT.*

By G. H. GAMPER.†

A great deal has been said in regard to the cost of operating a municipal plant and that it generally costs a municipality more to operate a lighting plant than it would cost a corporation. This should not be true. The reasons for it are that there is generally no system of cost keeping to ascertain where the money is spent, and no administrate organization, because of political changes; the employees being appointed by the Board of Directors or by the Public Service, which allows the Superintendent very little authority in regard to the selections of the men, consequently it is also a very difficult matter to maintain discipline. The superintendent is, as a rule, selected for his ability. This is also true in regard to some of the employees.

The superintendent appointed may start a system of records, but after realizing the amount of work involved, will drop it, saying, if he feels that he may not be reappointed, "Let my successor devise such cost systems, if he wishes them," and consequently none are ever installed. This has been the case with the municipal light plant at Columbus, but since the first of this year it has been divorced from politics and placed on a strictly business basis.

The system which is in use at the Columbus municipal plant has been in force since March 1, 1908, but owing to the men not being familiar with such a system and the amount of work necessary to get it started right, it was not running smoothly until July 1, since which time an accurate record is kept of everything. Before a job is started, either new work or a repair job, a cost and time estimate is made out by the foreman or whoever is in charge of the work to be done. A foreman's job order is issued to the foreman, which is filled out in exact duplicate of the job order on file, on which the foreman enters the time, check number, and material used. This is used as a check on the storeroom requisitions and time.

The cost and time estimate is submitted for approval, which gives the superintendent a chance to determine for himself whether this work is necessary, or whether it can be done in a different way with less cost. When it is approved, it goes to the clerk, who fills out a job order blank and gives the job a number. This blank is kept on file in the office, together with the cost and time estimate. Every day, the time of the men working on this job order on file in the office is entered on the back, giving the man's number, his rate, the date, and total time. On the front is entered the requisition number, the date, the amount of material and value of the material, or the name of the firm and amount of their invoice.

On the completion of the job, the foreman sends in his job order marked complete, and the job is then closed, the labor is calculated and entered on the front, and is added in with the material. If any material is taken out for use on the job and not needed, it is returned to the stock-room and the storekeeper sends in a credit slip. This is deducted from the cost and an actual cost of the job is obtained.

A list of what is called General Job Orders are issued each month. On these job orders are entered the small items, such as packings, gage glasses, oil, waste, etc., and anything that costs under a dollar. These are closed each month. After the job orders are closed for the month and the cost calculated, the latter is then distributed to the different accounts, which are enumerated in the upper right-hand corner of the blank. The sum of the different accounts is then entered on the monthly reports.

In making out requisition for supplies, two blanks of different colors are used; one which is numbered is used for supplies drawn from the store room, if the material is in stock. If it is not in the storeroom, the storekeeper sends in a white requisition to the office for the material, either for stock or for the job. If the amount is small, it is purchased direct, but if it is a large amount, a quotation sheet is sent to the different supply houses, which is returned, properly filled out with prices. The lowest and best quotation is accepted. A requisition in triplicate is then issued, numbered in the upper left-hand corner. Below the requisition number appears the job order number, and in the upper right-hand corner the fund from which the bill is paid. The requisition contains the firm's name, the material, and prices. These requisition blanks are of different colors; the white copy goes to the dealer, the pink copy to the auditor with the voucher and bill for payment, and the yellow copy remains on file at the office. This yellow copy has the receipt of the storekeeper or whoever received the goods, the date the bill was approved, and the person's name who checked it. If at any time in looking over a completed job order, information is wanted as to what was furnished, it is only necessary to go to the requisition file and look up the number of the requisition as given on the job order and ascertain exactly what that requisition called for.

If a job requires the use of a horse, the horse's time is charged to that job. The total cost of the stable for the month is determined and divided by the number of horses, which gives the cost of each horse per month. This cost is then divided by the number of days in the month and then by the number of hours in a day, which gives the horse's hourly rate to be charged for the horse's time.

In regard to the monthly reports, everything is taken into account: the service, transmission, generation, expense, etc. On this report is given the complete gross cost of the lamp per month, also the cost per lamp up to date, and these are compared with the previous year. In determining the cost of the fuel per month, the cost of handling the coal and ashes is taken into consideration; all the coal being weighed as used gives a very accurate cost of the fuel consumed. The administration expense includes all the office force, from the superintendent down to the janitor and storekeeper. A sinking fund is provided to take care of maintenance costs and depreciation, which is based on the value of the plant.

A boiler-room and turbine-room log sheet is kept. On the boiler-room log sheet hourly readings are taken of the superheat temperature, the flue gas temperature as it leaves each boiler and before and after leaving the economizer, feed-water temperature before entering the boiler and before entering the economizer, and the draft in the combustion chamber of each boiler. The object of reading the temperatures is to keep a check on the foreman and on the conditions of the boilers and furnaces. Provision is also made to connect up at a moment's notice an Orsat gas apparatus to analyze the flue gas s. By these checks a fireman is always compelled to do his best and give explanations if he does not. A record is kept of the amount of coal consumed and the amount of water evaporated, which is determined by hot water meters; the evaporation per pound of coal is thus determined and a record is kept of it. On the turbine-room log sheet is kept a record of the total output of each phase, pressure, vacuum, primary volts and amperes of each generator in operation, also volts and amperes of exciters, power factor, and, finally, the KW. and amperes of each circuit. By a special arrangement of connections, the Kilo-Watts of each circuit can be read direct from a common meter. This avoids the necessity of multiplying the volts by the amperes.

The "outages" are reported by the police and citizens directly to the plant. The switchboard operator who takes these reports, fills out a trouble blank, giving the location of the lamp, the time reported, and the party reporting the same and the date. These are given to the trimmer whose district is nearest the lamp reported out. If he can repair the lamp, he does so and fills out the lower part of the blank stating the trouble, the number of the lamp, the time repairs were made, and the job order number, and signs the blank returning it to the office, where it is filed. If he cannot locate the trouble, the lamp is taken down and replaced by another one. The blank on which he records the time when the lamp was taken down and the number of the lamp which replaced it, is placed inside of the lamp and the lamp repairer makes the report as to the cause of the trouble. In this way the "outages" can be reduced to a minimum.

In working out our lines and trimmers' routes, a city map is pasted on a board. Brass nails are driven in the board wherever a lamp is located. By means of different colored threads, the trunk lines and loops are swung in. Also a thread is used to show the exact route and lamps each trimmer is to trim in his district. These districts and routes are determined by the Chief Electrician and are type-written—a copy being given to each trimmer and one kept on file in the office. By this means the shortest possible route can be taken and we are independent of the trimmers, as a new man can be put to trimming without loss of time. Before this method was used it took four trimmers to trim the lamps and one man to take care of the outages. Three men are now trimming the lamps and taking care of all outages without trouble, and instead of trimming an average of 80 lamps per day, they are now trimming on an average of 140 lamps per day and taking care of the outages.

A great deal of trouble has been experienced with the wire-using corporations of Columbus making use of the city poles at will, also taking out city poles and substituting their own. To prevent them in the future from doing this, a complete record of the poles has been obtained. A separate card is made out and kept on file of each pole, giving the number, location, height, wire, etc., and on the back of the card a record of foreign contact. A complete description of each pole can now be obtained from the files and any changes noted.

All the switchboard instruments are calibrated every month, precision meters being purchased for that purpose. From every car of coal a sample is taken and analyzed, and should the coal fail to come up to standard, it is rejected.

The system installed at this plant seems to the observer at first glance to be complicated and unnecessary, but when working properly, it is a very easy one to handle, and savings effected are many time the cost of using it. By watching the boiler-room log sheets, the recording gage sheets, the saving in fuel has been over 50%. The fuel consumption per KW.-hr. was reduced from an average of 6.5 lbs. per KW.-hr. to 3.1 lbs. per KW.-hr., and better service is obtained with less labor. By examining the monthly reports the leaks can be located and eliminated, and the cost of operating the plant can be reduced to a minimum.

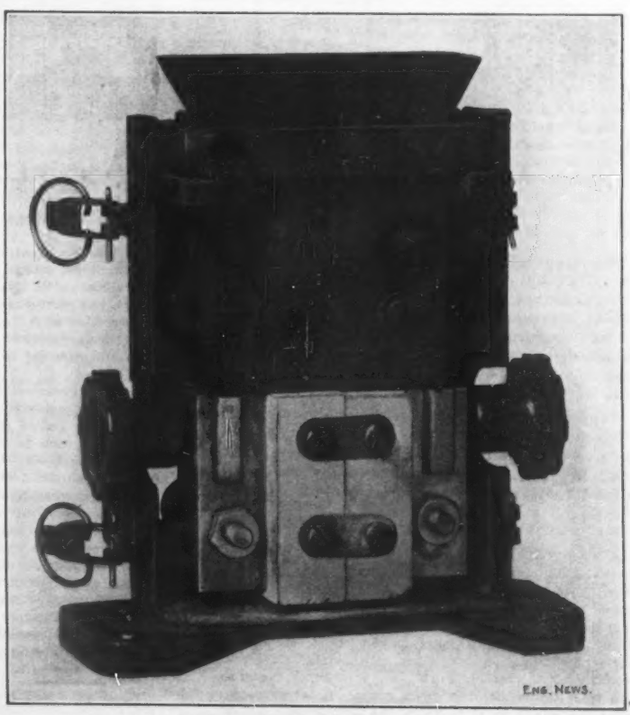
There are up to the present time 2,120 lamps in service. There will be by the end of next year 2,350 lamps. There have been installed in the past three months 110 new lamps. There will be about 25 more lamps installed by the end of the year, which will leave 125 more to be installed as soon as possible or as soon as the lines are built. The cash cost per lamp from the first of July to the end of the year will be approximately $13.10. This includes the new improvements. Half the cost of the new improvements should be charged to the plant account and the other half to operation, as they displaced old machinery. This will bring the actual cash outlay per lamp to $10.20, or an approximate gross cost of $49 per lamp per year. This will be reduced considerably next year, as a great deal of the expense this year will not be necessary and the improvements will make a much greater saving and there will be a greater number of lamps in service, with very little additional expense connected with the operation and maintenance.

*Extract from a paper read at the meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers, Nov. 21, 1908.

†Superintendent Municipal Lighting Plant, Columbus, Ohio.

FUSE-BOX TO REPLACE RAILWAY CIRCUIT BREAKERS.

The management of many street railway lines have found that the ease with which the motorman could replace the car-type of overload circuit breaker was undesirable for proper oper-



FUSE BOX FOR STREET CARS.
Westinghouse Electric & Manufacturing Co., Pittsburg.

ation of the car. To satisfy the demand for a simple fuse, giving certain extinguishment of the arc, the Westinghouse Electric & Manufacturing Co., of Pittsburg, has designed and is selling the magnetic fuse box shown in the accompanying figure.

The general design of this fuse box is similar to that of a street car circuit breaker in that it has an all metal case with the live parts entirely enclosed. It is intended to be placed under the car. The main current is carried by a short copper strip extending down from the terminals in the form of a loop. This loop passes through an arc chute which is supported inside of laminated punchings, thus providing an efficient magnetic blowout. The blowout is produced by the ribbon itself without any exterior coils whatever, as a single turn of the ribbon through the iron circuit provides ample magnetism to blow out the arc formed when the ribbon melts. This fuse box will carry 400 amperes continuously without overheating, while the fuses are rated at from 250 to 600 amperes, and are so constructed that they will blow in 30 seconds on 100% overload. New fuses may be readily inserted by turning the insulating handles on each side of the box without opening the case or using any tools whatever. For the purpose of repairs the sheet iron front of the box may be readily removed. The arc chute is a single piece and may be readily and cheaply replaced. This fuse box, while intended primarily for street cars, may be used on industrial motors wherever enclosed fuses would be unsuitable for any reason.

SEPARATION OF GRADES OF CITY STREETS at a crossing is proposed at 42d St. and Fifth Ave., New York City, and the plan has been favorably reported upon by the engineers of the Board of Estimate and Apportionment. The crossing is one of the busiest in the city, and it is necessary to stop traffic on first one street and then on the other, alternately, to prevent accidents. At present, Fifth Ave. approaches the crossing from the south on a down grade. It is proposed to alter this grade so as to carry the avenue over 42d St., on which change of grades will also be necessary for a considerable distance. The total cost is estimated at about half a million dollars.

CENTRIFUGAL-PUMP FIRE-BOATS.*

By CHARLES C. WEST.†

The modern fire-boat has become a necessary adjunct to the fire department of sea, lake or river cities, and is viewed by underwriters as an important factor in determining insurance rates. Not only is the fire-boat a necessity for the extinguishing of fires along a water front or for protecting shipping but it is now rapidly coming into use as an auxiliary water supply to the municipal pumping plants in cases of large or dangerous conflagrations. The pressure maintained and the volume supplied by the ordinary water supply system of the average city is insufficient in extreme cases and most of the large cities are now installing the system of water mains drawing their supply directly from the water front. The absolute feasibility and practicability of this high-pressure main system has been demonstrated and when these mains finally extend some distance inland, as they some day will, there will be higher pressure and more capacity required of the pumps on the fire-boat.

The City of New York has lately opened some high-pressure pumping stations on different points in the water front for fire protection, consisting of multiple-stage centrifugal pumps operated by electric motors. A good fire-boat with its shore connections accomplishes, of course, the same purpose. The commercial advantage which almost always causes a business congestion near a water front demands ample protection and therefore the size and capacity of fire-boats have grown with the cities.

Owing to the comparatively temporary nature of American building construction, the fire-boat has been developed in the United States more rapidly than in foreign countries, and to-day the boats of largest capacity are to be found over here. In the design of a fire-boat, local conditions are of course of importance in determining such considerations as speed, ice-breaking and maneuvering qualities, etc., but in view of the fact that a fire-boat is merely a self-propelled pumping plant, interest centers in the pumps and the many fittings not common to other craft. For years there has been little difference in the great number of fire-boats built in all parts of the country. In most cases identical pumping machinery was used, differing only in the number of units installed. These units consisted of double-cylinder, vertical, inverted reciprocating pumps, each unit having rated a capacity of about 3,000 gals. per min.

In order to get a smooth nozzle stream [illegible] sufficient pressure and have the pumps contained [illegible] limited space offered by an ordinary hull, it was [illegible] to run these pumps at an exceedingly high speed [illegible] a consequence, however, the strains on the mach[illegible] are enormous, in addition to which was the ever-[illegible] danger of valve trouble. The reciprocating pump[illegible] ever, has served its purpose creditably, but the [illegible] which has come for higher pressures makes its f[illegible] adoption questionable.

The development of the centrifugal pump [illegible] multiple-stage variety is comparatively recent, [illegible] the advent of the steam turbine has aided in its a[illegible] owing to the high speed obtainable. In the h[illegible] equipped with turbines and two-stage centrifugal pum[illegible] use at the present time, there has been no difficult[illegible] obtaining higher pressures than are possible in [illegible] reciprocating pump. This pressure can be easily [illegible] by increasing the number of stages with no [illegible] on the structure or working of the pump.

The turbine used so far in operating these [illegible] trifugal pumps has been the horizontal-impulse type. While this type possesses the advantage of being more compact than the reaction turbine, it is also claimed by the builders that it can be started without being warmed up, a performance said to be dangerous in the reaction turbine owing to the liability of warping the spindle.

In the operation of fire-boats of late years the latest practice has been to use hose lines less and discharge the streams either directly from the boat from stationary nozzles or, as before mentioned, into underground water mains. With the powerful streams now at the command of the firemen, it is of course necessary that the huge nozzles used be not only fixed to the boat but also mechanically operated. This is done either by affixing them to towers, to tops of deck-house or to platforms. Hose connections are made either with the bulb turrets illustrated herein or by quick-opening valves on the sides of the deck-houses.

Inasmuch as the interest in a fire-boat centers in her pumps, and as the turbine centrifugal pump and outfit represent the latest practice in this line, the writer gives the result of a test made on the first of the two 9,000-gal. boats designed by Mr. W. I. Babcock for the city of Chicago and just delivered to them. This boat is shown in the accompanying figures.

The general dimensions of these boats, the "Joseph Medill" and the Græme Stewart," are:

Length over all, 120 ft.
Length of keel, 100 ft. 6 ins.
Beam, 28 ft.
Depth, 15 ft.
Displacement, 500 tons.
Draft, 9 ft. 6 ins. mean.

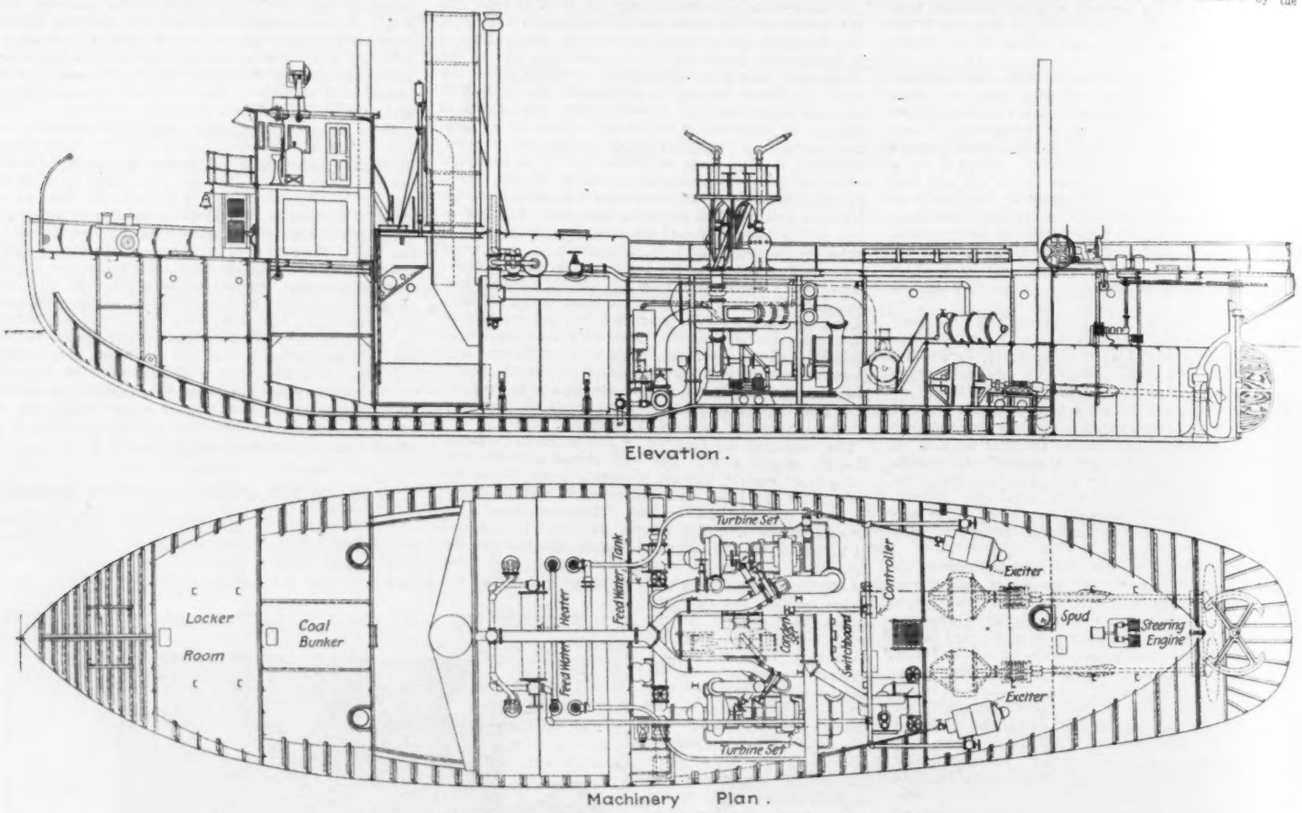


FIG. 1. PLAN AND PROFILE OF FIREBOAT "JOSEPH MEDILL."

*A paper read at the sixteenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 19 and 20, 1908.

†Manager, Manitowoc Dry Dock Co., Manitowoc, Wis.

In the plans it will be noted that a unique propulsive scheme was used. The main pumping and power machinery consisted of two 600-HP. Curtis turbines direct connected to 200-KW., direct-current generators and two-stage centrifugal pumps. The generators served to provide current for the propelling motors which are of the variable-speed reversing type. There are two pumping-generating sets in each boat, and twin screws. In going to a fire the pump impellers run dry. Control of these motors is possible by rheostats in both the pilot-house and engine-room and in the test the captain easily handled his boat without the aid of the engineer. Steam was supplied by two two-furnace Scotch boilers, 11 ft. 6 ins. long by 12 ft. 6 ins. diameter; 1,910 sq. ft. heating surface in each boiler and 42 sq. ft. of grate surface. Forced draft is provided on the closed stoke-hole system.

In the Chicago River, where these boats are to be used, most of the old center pier bridges have been removed and it is necessary at times for a fire-boat to maintain itself in the middle of the river. On this account mooring spuds operated by steam gear were adopted.

As shown in the drawings the principal water outlets consist of two monitor nozzles placed on a platform directly above turrets on which are the hose connections. The pumps, though usually run singly, can be compounded, and a nozzle pressure of over 300 lbs. was thus obtained on the test with a resultant capacity of about 5,000 gals. per min.

In connection with this boat, the results of an eight-hour endurance test may be of interest. Owing to the late date at which the test was held, it is impossible to work up the test in more detail, but the data given show the average performance of the machinery during this run.

NOTES ON EIGHT-HOUR ENDURANCE TEST.—Coal consumption was measured by leveling bunkers before and after test and estimating the weight from the cubical contents, the weight per cu. ft. being determined from samples. Feed water was run through a hot-water meter and measured, and the meter afterwards calibrated. The make-up feed which measured the steam consumption of the auxiliaries was also metered, and this reading, deducted from the total water used, gave the steam consumption of the main turbines. Pressures at the nozzle were measured by a Pitot tube held in the stream.

A few summarized items of the test follow:

Date	Oct. 28, 1908.
Duration of run	8 hours.
Barometer	29.53 ins.
Revolutions.	
Turbine, starboard	1,660
Turbine, port	1,634
Circulating pump	285
Dry vacuum pump	123
Blower engine	537
Pressures.	
Boiler pressure,* starboard	156.8 lbs.
Boiler presure, port	156.5 lbs.
Main steam at turbines, starboard	156.5 lbs.
Main steam at turbines, port	154.0 lbs.
Condenser vacuum gage	27.3 ins.
Draft gage in fire-room	0.83 ins.
Centrifugal fire pumps, starboard	157.5 }
Pressures, port	157.0 } 157.25 lbs. mean.
Nozzle pressure, starboard	101.3 }
Nozzle pressure, port	101.0 } 101.15 lbs. mean.
Number of nozzles	2
Diameter of nozzles	4 ins.
Gals. water discharged per nozzle per minute	4,800
Gals. total boiler discharge per minute	9,600
Gals. total boiler discharge per hour	576,000
Water HP. of pumps, each	442.5
Water HP. of pumps, total	885.0
I. H. P. turbines, total	1,172.0
Coal burned, total	26,500 lbs.
Coal burned, per hour	3,310 lbs.
Coal burned, per sq. ft. G. S. per hr.	39.4 lbs.
Feed water, lbs. per hr.	23,750
Make-up water, lbs. per hr.	2,206
Steam consumption:	
Steam turbines, lbs.	21,544
Water rate turbines, lbs. per hr. per B. HP.	18.4
B. HP. per sq. ft. of G. S.	14
Coal, lbs. per B. HP. per hr.	2.82

*Boiler gages are placed in engine-room over switchboard. This would probably account for the small drop in pressure between boiler and turbines.

Because of the unusual character of propelling machinery, some items in connection with the trial-trip performance may be of interest. The boat was run over a course from the Manitowoc breakwater to a point opposite the breakwater at Two Rivers, Wisconsin. The two breakwaters are very nearly parallel and the course as measured from the Government charts is 5½ miles. The time of start and finish was taken, and readings of r. p. m. and switchboard were taken at 5-min. intervals. The results follow:

Date	Oct. 30, 1908.
Distance	5½ miles.
Time	28.25 min.
Speed (statute mi. per hr.)	11.7
R. P. M., starboard motor	179
R. P. M., port motor	178
HP. developed:	
Motors, starboard	203
Motors, port	166
Output of generators, starboard	181
Output of generators, port	223
Motor efficiency, starboard	91.0%
Motor efficiency, port	91.8%

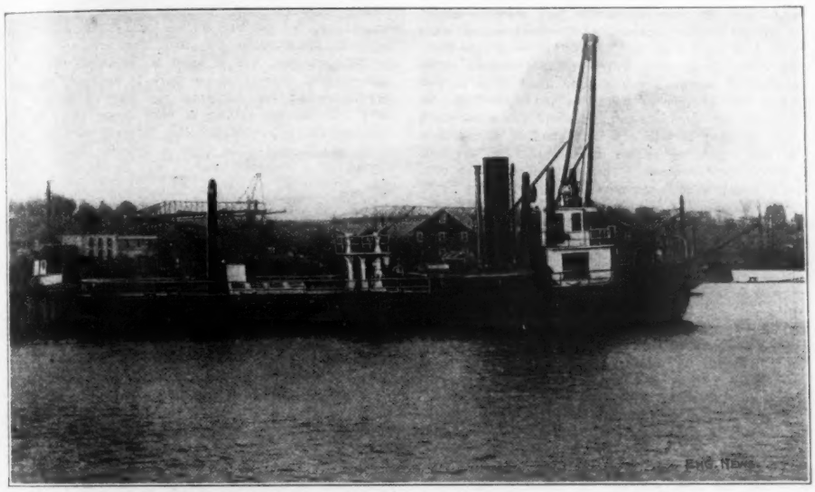


FIG. 2. THE CENTRIFUGAL PUMP FIREBOAT "JOSEPH MEDILL."

The data obtained from the foregoing test shows not only that the centrifugal pump is a more powerful and reliable machine than the old type but also that the greater economy of the turbine outfit makes it possible to do more work with about half the boiler capacity. Comparing the water rate of these turbines with that of a high-pressure pump taking steam for almost full strokes demonstrates the fact that there is probably no boat afloat of the same size that has the pumping capacity of the "Joseph Medill."

While the guaranteed capacity of the boat was 9,000 gals. per min. the 8-hr. endurance test showed an average delivery of 9,600 gals. As may be surmised, the builders ran the test with the idea of fulfilling their contract and not to make a record. It is safe to say that this boat, if crowded, will deliver between 10,000 and 11,000 gals. per min. at 150 lbs. pressure.

THE OLDEST IRON SHIP IN THE WORLD.*

By HENRY PENTON.†

Sixty-six years ago there was dragged across the mountains from Pittsburg to Lake Erie the material out of which was constructed what is now, and has been for some years, the oldest iron ship in the world. The trip was not then, as now, a matter of a few hours when over the same route all the ore necessary to produce this entire ship is transported in half a day and in a few cars. One of the ore trains of the present day indeed carries enough ore in its 80 50-ton cars to produce the material for four such ships. But at that time neither the ore nor the trains were dreamed of. The ship had rounded out a decade of service before the first shipment of ore came from Lake Superior. But the plates and angles, bars and beams, bolts and rivets, forgings and castings, were all gotten out at Pittsburg, laboriously transported across the mountains and dumped at the hamlet of Erie on the shore of the lake, and out of them grew the U. S. Man-of-War "Michigan," which since that time has continued to be the whole United States Navy on the Great Lakes, where treaty obligations restrict naval representation to one ship on each side.

Few people are now living who even remember her launching and probably none who took any part in her construction. She does not amount to much, judged by modern standards, but that she was a fine ship in her day we may well believe and she answers her purpose to-day just as well as then. This purpose is almost entirely confined to putting in an appearance at the chief lake ports during the season of navigation to enlist recruits for the newer and bigger ships of the modern navy and acting as drill-master at the annual summer-practice maneuvers of the naval militia of the lake states. Even the firm who built her, Stackhouse & Tomlinson, of Pittsburg, has passed away. Many a naval officer who has risen to high rank, and in his turn has passed away, at one time or another stood his watch on her decks or snored away his watch below on the "Michigan." But the old ship still survives, though the Act of March 3, 1905, which authorized two battleships, appropriated her name for one of them and renamed her the "Wolverine." There is no reason why, barring accidents, she should not still be in service at the end of her century.

In the navy list she is rated as an unarmored, unprotected cruiser, with a water-line length of 165 ft.; beam, 27 ft.; displacement, 685 tons; I. HP., 365; speed, 10.5 knots (12 statute miles); coal endurance at 10 knots, 2,240 knots or 224 hours; bunker capacity, 100 tons. She does not cut much of a figure alongside the new "Michigan" recently launched, with a length of 450 ft., beam 80 ft.; displacement, 17,600 tons, 16,500 HP. and 18½ knots speed. The eight 12-in. guns alone of the new ship would sink the old, even if she were lightened of all her machinery, coal and stores. A quarter of the new ship's coal supply would do the same thing.

Each, however, represents the most advanced type of naval construction of her time. But what changes have taken place since the old ship took her first dip in the waters of Lake Erie! The famous "Hartford," a wooden ship, Admiral Farragut's flagship at New Orleans, was not built until the "Michigan" was 15 years old. About the same time the British and French three-deckers were hammering away at the walls of Sebastopol. She was a veteran when Ericsson's "Monitor" threw all the navies of the world into the junk-pile, and many and many a generation of fighting ships have come and gone since then. She was 40 years old when the first ships of our so-called new navy were authorized and they have been gone long years since. Her iron construction was a novelty in naval work, and for years afterwards the United States continued to build wooden ships for its navy, including the famous "Kearsarge," which was built 20 years after the "Michigan." Even the "Constellation," a ship that shares the honors of the old sailing ships of the navy with Old Ironsides, did not come until 1854.

The "Michigan" has been a noted ship in other ways, too. Much of our steam engineering knowledge is based upon the early experiments on expansion of steam, superheating, steam-jacketing, condensation, etc., carried out on her by B. F. Isherwood, afterwards Engineer-in-Chief, U. S. Navy, when attached to her. The value of those experiments, and the theories deduced from them, to the world at large are beyond computation and they are to this day quoted as authority.

The engines are of the simple inclined type with two cylinders 36 ins. diameter, 8 ft. stroke and, although of an antiquated type and despite their age and service, their condition is stated in the Bureau reports to be good, while that of many of the comparatively new ships is reported as "fair" or "condemned." They are sufficient for the service required, however, and it is doubtful if even modern designs would be any more satisfactory for the limited duty. An old and rare work, entitled "A Treatise on the Marine Boilers of the United States," published in Philadelphia in 1851, supplies much interesting information regarding the "Michigan" in early years; she was then considered a remarkable ship. From this it appears that the original paddle-wheels were 21 ft., 10 ins. in diameter and had each 16 paddles or buckets. Each bucket was 7 ft., 6 ins. long, in two parts and 25 ins. wide, also in two widths of 15 ins. and 10 ins., or four sections to each bucket. The dip of the wheels was 32 ins. and the maximum r. p. m. 22. The draft of water was 7 ft., 8 ins. The boilers were of the "box" type, 8 ft., 6 ins. wide, 19 ft. long and 9 ft. high and the working steam pressure was 15 lbs. per sq. in. This book also shows drawings of the boilers. These old boilers were of course long since obsolete, and were replaced by others of a modern type, at which time new paddle-wheels of smaller diameter were also fitted. The draught is also increased to 9 ft., no doubt partly due to the increased boiler weights and partly to increased coal capacity made possible by

*A paper read at the general meeting of the Society of Naval Architects and Marine Engineers, New York, Nov. 19 and 20, 1908.

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shorter boilers. As originally built the ship was barkentine rigged, but a number of years since this was discarded and a schooner rig substituted. But the hull and engines and most of the equipment, except armament, remain as they were built 66 years ago.

A Cleveland paper has suggested that the old ship be sent as a transport of honor with the Michigan delegation who will probably bear the customary silver service to the new "Michigan," and that sending her back be forgotten and something more modern be sent to take her place. There is not much likelihood that the old ship will ever float on anything but fresh water since she cannot get through the canals without dismantling her paddle-boxes and wheels, and entirely aside from the fact that she is of just as much service to the country as a newer and more modern as well as a more costly ship would be, we hope there is enough sentiment among us to keep the oldest iron ship in the world in service as long as she will hold together. We are called a practical people without any regard for that which is old even when fully as serviceable as the new yet we have spent and continue to spend a lot of money on our Old Ironsides for sentimental reasons alone. The "Wolverine" has not only a sentimental value, but she is in active service and has done what the "Constitution" never did—she has contributed much to material progress. She is likely for many long years to come to make tangible returns for the money spent on her. The most graceful thing the Navy Department can do and the greatest compliment it can pay, not only to the old ship herself but to our neighbors across the line, is to continue her in commission. We do not need, and it is to be hoped we will never need, a ship of war on the Great Lakes; our friends maintain none and a newer and more offensive ship would be merely a gratuitous evidence of mistrust.

A COMPARISON OF THE THIRD RAIL AND SINGLE PHASE SYSTEMS OF THE NEW YORK CENTRAL AND NEW YORK, NEW HAVEN & HARTFORD RAILWAYS.

The leading article in the "Bulletin of the International Railway Congress" for November is a paper by M. E. Uytborck, an engineer of the Belgian State Railway, entitled "Notes Taken During a Journey of Inquiry in the United States." M. Uytborck's studies appear to have been almost wholly devoted to recent American practice in the electrification of steam railways. He devotes chief space to a description of the systems installed on the New York Central and New York, New Haven & Hartford railways, for their passenger lines entering New York City, although he also gives attention to the Pennsylvania Railroad's Atlantic City line and to a single-phase interurban line between Pittsburg and Butler, Pa.

There has been so much discussion concerning the relative merits of the two competing systems of electrification, that it is of much interest to learn the opinions reached by an independent engineer after careful examination of the two. We therefore reprint below the summary of conclusions reached by M. Uytborck.

It now remains for me to criticize and compare the systems adopted in the four electrifications which have just been described.

We must remember that an electrification must be considered not only from the point of view of the extent of the district which is to be electrified, but also from that of the present and future magnitude of the traffic and of its nature. As the voltages which can at present be attained with perfect safety are somewhere about 70,000 volts, and as these tensions allow the energy to be conveyed without serious loss to places at least 62 miles off, it must be admitted that the question of comparing the relative sizes of the districts to be electrified is at present of secondary interest, as all the systems considered would enable such district to be extended to beyond the limits generally desired.

It is therefore more convenient to use another important factor in differentiating these electrified lines, namely the traffic.

Three cases arise: (1) the traffic is actual, existing lines are electrified; (2) the traffic is latent, two centers between which there is already an interchange of traffic are connected by a new line; (3) the traffic has to be created, the new line runs through a region which has no means of rapid communication with the neighboring business centers.

The engineers who have to solve electrification problems, too often neglect to attach sufficient importance to this factor of traffic, which, in my opinion, is in most cases the determining factor in selecting the system of electrification.

The reasoning frequently adopted is as follows: the district to be electrified extends over a great many kilometers; it therefore cannot be thought of supplying, over such a distance, continuous current to the cars, and equipping a large number of sub-stations.

Is it not human, when science has discovered methods enabling electric energy to be transmitted over great distances, to extend the use of these methods to cases which could have been solved more economically by methods previously known and used? Do we not all know installations where three-phase transmissions and distributions are used, without special reason, when continuous-current distribution would have been cheaper? Have we not seen certain installations with high-tension transmission, where continuous current at 250 volts would have done all that was necessary? There is no doubt there is a current of ideas, a fashion in electrotechnics, a fashion which is to be distrusted as it tends to give preference to a solution for the simple reason that it is new, and that some installations so equipped have been working well.

The two first electrifications we have considered, the New York Central and the New York, New Haven & Hartford are instances of what has been called the electrification of railway main lines, and it is very interesting to compare these. It is here a question of a traffic which exists, of a very busy traffic consisting chiefly of numerous and heavy passenger trains, both express and ordinary.

We know that overhead conductors are not advisable for supplying powerful continuous currents, and that as a rule, a third rail (of steel) is laid along the track for supplying the current. On the other hand, as regards high-tension and alternating current, overhead conductors alone need be considered. It may then be asked, leaving all the other factors out of consideration, what system is best suited for the main lines of a railway?

A first point to consider is the difficulty which arises in the case of overhead conductors, when it is desired to increase the number of tracks of the same line; for it is desired, on the one hand, to make the wires from which the current is taken, as independent as possible, and on the other, to reduce the number of supports which such wires require. The cost of overhead conductors is much greater at curves; and when an existing line is electrified it may be said that every individual constructive work requires a special modification of the arrangement adopted on the open track. The third rail, on the other hand, is laid anywhere with equal ease. If a track is to be shifted, its third rail can be shifted simultaneously and the operation takes but little time. If a third rail has to be replaced, it can be replaced as quickly as a track rail. Can the same be said about overhead conductors? Certainly not.

It must however be admitted that the presence of a live rail at track-level entails a certain amount of danger; but as regards the supply of current by overhead conductors, can this be carried out without employees having, by the very nature of their duties, to come near to the high-tension conductors? On the New York, New Haven & Hartford Ry. there have been ten fatal accidents on the line, whereas on the New York Central, owing to the third rails being protected on the Wilgus and Sprague system, there has been but one fatal accident.

Finally, what system is to be preferred should a serious accident take place within the electrified zone, the overhead system or the third rail? When there are several parallel tracks, it has generally been considered advisable to support the different wires over the four tracks by one common support. If a derailment occurs on one of the outer tracks, there is no doubt a certain risk of one of the supports being knocked over, and this would stop the working on all the lines; it is even possible that all the poles, up to the nearest anchorages, would become twisted or bent. How much time would the repairs after such an accident require? In the case of the third rail, the objection may be raised that there would be a risk of setting fire to the derailed rolling stock, by short-circuiting the third rail and the running rails. This is a possible case, but generally the short-circuit would be momentary and the automatic cut-off would act at once. We have shown in the first part of this article that a suitably-protected third rail is hardly a source of danger even to strangers walking about on the track.

On the other hand, however, strongly an overhead line may be constructed, a contact wire may break. If catenary suspension is used, the ends of the broken wire will not reach the ground but will remain suspended. If a train or automotor vehicle running at high speed then arrives, the collectors will be torn off and the overhead system seriously damaged. There is also another possibility: as the high-tension tractors are generally equipped with two collectors, any weakness in the overhead system may occasion the fracture of the contact wire when the first collector passes; the broken wire will certainly tear away the second collector. This is mentioned to meet the objection that certain appliances could inform the nearest signal cabin when a contact wire is broken, and that the cabin could then stop, by means of signals, a train before arriving at the point where the fracture occurred.

I have mentioned all the possible points of comparison between the two systems of supplying [illegible]. In my opinion, it is scarcely doubtful that, in [illegible]re, more extended applications of the third rail [illegible] made, overhead conductors being confined to [illegible]econdary lines where separate supports are provid[illegible] the two tracks and where the constructive work[illegible] will be necessary can be designed so as to leav[illegible]able the space required for the conducting wire[illegible] is the case of new lines to be electrified which [illegible] of the character of railway main lines.

What is to be selected when electrifying [illegible]y main lines, continuous current or monophase [illegible]? This is a very controversial question over w[illegible]ich ink has already been split, and more will yet [illegible]pilt.

It will be convenient to review the a[illegible]ges and the disadvantages of the two systems; we [illegible] then be in a position to draw our conclusions.

(1) STAFF, MATERIAL, COST OF MAINTENANCE AND OF SUPERVISION.

In the case of monophase current, the high-tension energy cannot be taken direct at the voltage [illegible] the central station except within a certain distance. If it is desired to exceed this distance, the tension must be raised for the transmission and reduced for the distribution. The efficiency is thereby appreciably reduced. The transformers for reducing the tension can be placed under shelter, and the presence of attendants can be dispensed with.

In the case of continuous-current distribution, more important buildings are required for the transforming apparatus, there being an extra appliance required: a rotary converter converting the alternating current generated at the central station into continuous current. In such sub-stations therefore, the presence of a staff is indispensable; but it must be admitted that at most sub-stations, one employee only is required for the supervision and for carrying out any operations necessary. If the sub-station is very large, there is always the resource of equipping the different switches so that they can be controlled from a distance and of thus reducing to a suitable amount the duties of the electrician in charge.

In the electrification of the New York Central, the duties of the substations are carried out by one man, and the average distance between substations is 6.2 miles.

Let us compare this staff with that required on the 11,000-volt monophase line of the New York, New Haven & Hartford an interesting comparison, for it is often thought that on monophase railways, no staff is required for the distribution of the traction current.

On the New York, New Haven & Hartford, at every 2 mi. is a switch-bridge, the appliances of which act as sectional cut-outs and automatic cut-outs.* In the signal cabin nearest to the switch-bridge, there is an employee charged with the supervision of the switchboard for controlling from a distance the cut-outs of that bridge. Instead of having an electrician every six miles as in the case of continuous-current distribution, an electrician has to be at every two miles in the case of monophase-current distribution. It may be objected that in the latter case, the work the employee has to do is much less than in the former, and that he can even attend to these duties in addition to others; for instance, those of a signalman. That is quite true as far as the ordinary signaling systems are concerned, but it no longer applies if an entirely automatic block-signaling system is used, without the intervention of any signalman; and such systems are being applied more and more in the United States.

The comparison which has just been made requires no criticism and is entirely in favor of continuous current.

It cannot be denied, on the other hand, that the cost of supervision and of maintenance of the equipment of a continuous-current substation is greater than that of a monophase-current substation. To the equipment of the line we must add automatic cut-outs if any, the transformers for control from a distance, etc. This addition to the equipment of the substations is of considerable importance from the point of view of working expenses.

(2) EFFICIENCY OF THE POWER TRANSMISSION, FROM THE GENERATING STATION TO THE VEHICLES.

The efficiency of the transmission from the generating station to the vehicle is indisputably lower with the continuous current than with the monophase current: (1) because there is an additional transforming apparatus, that for converting alternating current into continuous current (in most cases: rotary converters); (2) on account of the rather low efficiency of these appliances under low loads; (3) on account of the greater losses admitted in the conductors transmitting the energy to the vehicles. It is not rare to see the efficiency of the transmission (measured from the bars of the central station to the vehicles) fall to about 60%, when the

*We cannot conceive working a railway main line without the use of appliances of this kind; for it would not be possible to allow any defect in the insulation of or any accident to the overhead line to paralyze the working on all the lines of a section.

traffic is not very dense and when the substations are far apart.

An objection generally raised against substations for converting alternating current into continuous current, is the fact that the machines must run light most of the time, and then be able at certain moments to supply enough power for two trains crossing each other within the district fed by the substation. It seems to me that the static transformers of a system of traction by alternating current work under similar conditions, the amount of loss being evidently less.

We would make a remark here, from the point of view of the traffic: when any zone is electrified, it is as a rule necessary to provide, on the one hand, for express trains which run beyond the electrified zone (these trains will in many cases be hauled by steam); on the other hand, provision must be made for the circulation of local multiple-unit trains which, by their frequent stops and by their large numbers, form as a rule the chief part of the load of the substations. At the beginning of an electrification, very often the trains hauled by steam locomotives are replaced by trains hauled by electricity. This way of operating gives rise to very varying loads at the substations. But after a certain time, giving way to the requirements of the public, long trains at long intervals are replaced by short trains at short intervals, and this way of operating local lines, while it is very favorable to the maintenance of a uniform load at the substation, is assuredly the best for getting hold of all the traffic available.

Let us assume, as an example, that we electrify the Brussels-Antwerp line. Everything seems to show that this line should have trains running every ten or fifteen minutes, the trains consisting of three or four cars in the busy hours and of one or two cars at other times. Under these conditions, the load of the substation would vary less, and the mean output would increase during the busy hours and on festivals. At those times which can be foreseen in advance, one or two extra transformer sets can be started.

When alternating current is used, is there the same flexibility and the same safety? Yes, if there is an attendant at the substations.

If the monophase-current stock as at present constructed, had the same qualities as the continuous-current stock, that is to say, if for the same power it had the same weight, the same price and above all the same properties in starting, it might easily be conceived that an enormous success awaits systems of traction by monophase current.

The monophase-current stock costs more than the continuous-current stock, not only owing to the greater weight of the equipment, but chiefly owing to the very many accessory appliances required, to be able to run either with monophase current or with continuous current, or at least with low-tension monophase current. For cases are rare in which high-tension monophase stock—and the use of monophase stock is not justifiable unless it is high-tension stock—can enter a town on the lines of urban tramways, or enter large stations, the shunting and sorting sidings of which extend into large goods yards. In a town or in goods yards, high tension is not permissible. If in the first case the solution by trolley wire under reduced voltage is possible, yet in the second case the third rail must be adopted, and this implies the use of continuous current. For in goods yards we cannot do away with cranes and travelers; and the use of these appliances requires a clear space above the cars, that is to say, that at such places there can be no overhead conductors for supplying current.

Those who have had occasion to travel by monophase vehicles well recognize the slowness of their acceleration as compared with that of the continuous current motor. This is due simply to the fact that although considerable current is absorbed at starting, it must be limited in order not to overheat the windings, since, otherwise than in the case of continuous-current motors, couples are not produced which are proportional to the current. We know as a matter of fact that with alternating current, the power is not equal to the product of the number of amperes multiplied by the number of volts absorbed, except in the cases where there is no phase-displacement of the momentary maximum values of these two quantities. It is more especially during starting that this phase-displacement, known to electricians as cosine ϕ, materially reduces the usefulness of the currents in the monophase-current motors. In the continuous-current motors, the current is directly proportional to the couple and consequently, any heating of the motor is necessarily the result of current which has done useful work. This is one of the chief defects in monophase-current motors, but it must be admitted that it is a capital defect, as it is in restarting that trains making frequent stops chiefly consume energy.

As I had the opportunity of making several runs on the continuous-current locomotives of the New York Central and on the monophase-current locomotives of the New York, New Haven & Hartford, I am able to give here several interesting figures which speak for themselves.

NEW YORK CENTRAL LOCOMOTIVES.—Weight of the locomotive, 95 tons. Weight of the train section with which I traveled, 175 tons.

In the regular service when hauling trains of this weight at speeds not exceeding 50 miles per hour, the four motors are never connected in parallel, but the trains are operated by two series of two motors connected in parallel.

When starting at the stations and when carrying out shunting operations with these trains at speeds not exceeding 9 or 12 miles per hour, the third rail only supplies 500 amperes momentarily and 400 continuously, at 600 volts.

The locomotives are powerful enough to haul the heaviest trains running on the line.

NEW YORK, NEW HAVEN & HARTFORD LOCOMOTIVES.—Weight of the locomotive, 87 tons. Weight of the train section with which I traveled, 105 tons.

When starting at stations and when carrying out shunting operations with these trains at speeds not exceeding 9 or 12 miles per hour, the third rail must supply, for the accelerations, continuous current of 1,800 and 2,000 amperes at 600 volts! This excessive consumption of current is due to the high voltage for which the motors had to be equipped for monophase running, and to the very considerable amount of energy converted into heat in the resistances. As soon as a start has been made, the speed increases without modifying the position of the controller, so that it is necessary to cut off the current in order not to exceed the speed required for the shunting operations. Running at low speed can only be effected by repeated starting operations.

As regards monophase running, there is the same disadvantage at low speeds. When a locomotive has to travel light or is hauling a few cars for shunting purposes or for making up a train, the driver has to cut off the current very frequently in order to keep the cars moving at a suitable speed. Thus the locomotive, when starting light, absorbs during 3 or 6 seconds 2,800 amperes of alternating current at a voltage varying from 320 to 520 volts; when starting with four cars the amperage rises to 3,000 amperes. These figures, referring to monophase running, are of less interest, as neither the voltage nor the cos ϕ could be determined exactly. But they prove that in all cases, shunting operations are carried out by taking considerable quantities of energy from the central station several successive times, instead of requiring a moderate and continuous consumption of electricity such as it is possible to achieve with continuous-current locomotives.

I have not laid stress enough on the fact, very important economically, that the monophase locomotives of the New York, New Haven & Hartford are not powerful enough to haul heavy trains.

It may be calculated that the New York, New Haven & Hartford, which has 30 locomotives, will have to order about fifteen locomotives for double-heading. Taking the cost of each of these locomotives at $32,000 at lowest, this represents an additional capital required of $480,000, representing, for interest and amortization, an annual expenditure of about $40,000, to which cost of repair and of maintenance has to be added.

Is not this expenditure, which the New York, New Haven & Hartford Co. will be unable to avoid, sufficiently great to make monophase-current more costly than continuous-current operating? I have a very definite impression that the continuous-current system of the New York Central, which is already better (from the point of view of reliability) than the 11,000 volt monophase-current system of the New Haven, is also superior to it from the point of view of total working expenses.

In my opinion, in the present state of electrical science, it is better, in the case of electric traction on railway main lines with much traffic, to use continuous current, and the advantage will be still greater if the already extensive applications of high-voltage continuous-current motors give the results which are expected. It seems that there is no disadvantage in allowing a third rail, carrying current at 1,000 or 2,000 volts, to be laid along a track, provided that this rail is properly insulated and protected; for the railway property is everywhere fenced off (in America, the legislature requires this to be done in most cases) and any one trespassing on it is fully aware of the fact that he risks being run over by a train or electrocuted by the third rail.

PITTSBURG-BUTLER LINE.

This line, as we have seen, is equipped for monophase current at 3,000 volts. It belongs to the third class we have considered: traffic to be created. In this case, we have a line which no one would think of electrifying except on the monophase-current system. The traffic is necessarily so small when such an undertaking starts, and grows so slowly, that the system to be adopted must be such that the line can be operated cheaply during the first few years. That is certainly one of the most remarkable achievements in connection with electric traction, and were it but for that we would have to feel grateful to the earnest investigators, such as Lamme, Eichberg, Latour, Finzi, who have worked out traction motors using monophase currents, which work satisfactorily.

I have stated that provision has been made to double, if the growth of the traffic made it necessary, the voltage of the monophase current supplied to the cars, to increase it from 3,300 to 6,600 volts. This, in my opinion, will be the second stage in the system of traction to be used on this line. Perhaps in the future this line will become more and more important, and the traffic will grow to such an extent as to justify giving up monophase-current traction in favor of high-tension continuous current. It may be asked whether it is with a view to this eventuality that most of the central stations for monophase traction make use of a three-phase current distribution which makes it so easy to supply continuous current by means of rotary converters.

PHILADELPHIA-ATLANTIC CITY LINE.

This line belongs to the second class. It unites two centers between which there is already an important traffic, and it is expected that the greater comfort provided for the passengers will attract some of the customers of the steam lines and even create fresh traffic.

The local trains carry but few passengers; the express trains are the important matter. The number of trains running at present can hardly be called considerable.

The system adopted for this electrification, of continuous current at 650 volts, could evidently be a matter of discussion if no increase in the traffic were to be expected, but it must not be forgotten that the traffic will increase very considerably, for the owners of the new line, the Pennsylvania R. R. Co., will in all probability abolish all the express trains running on the steam line, and will find it more advantageous to handle this traffic by means of electric trains on the new line. We see that, in the future, the line from Philadelphia to Atlantic City will have all the characteristics of a railway main line, and that then, according to my conclusions above, the selection made, of continuous current at 650 volts, is a judicious one, for it is made with the intention that its character of a secondary line in the near future will change to that of a main line.

It is worth noticing that there are not many substations; eight for a distance of 68 miles.

My conclusion is as follows:

On main-line railways, it is advisable to use continuous current at a tension of 650 volts, or more if possible. This eliminates overhead conductors and allows the use of the third rail, which alone is possible in goods yards, where there are machines for handling goods.

The use of high-tension monophase current must be reserved, in the present state of electrical science, to interurban lines extending over long distances, and on which the traffic will always remain comparatively light.

RAILWAY MAINTENANCE-OF-WAY.*

By E. E. R. TRATMAN.†

A new railway, fully completed, is in no sense and in no part a permanent structure. The embankments settle, cuts slip, bridges decay or corrode, ballast is blown and washed away, ties decay, rails are subject to rust and corrosion, and the roadway tends to run to weeds and dilapidation. In addition, there are the destructive influences of the traffic. The rails wear, joints and fastenings are loosened, ties are worn, ballast is crushed or disturbed, and the general line and surface of the track are distorted. Every train helps in the general destructive effect by its weight and its movement.

With the construction work completed, three classes of work have to be considered for the future: (1) maintenance, to keep the line up to the standard of its original condition; (2) repairs and renewals, to make good any defects and failures and the effects of wear and tear; (3) general improvement (and partial reconstruction) to bring the line to a higher standard in order to meet the increasing requirements of traffic and operation.

The maintenance-of-way and structures absorb more than 20% of the entire operating expenses, and half of this is for the ordinary roadway repair work. In other words, out of every dollar of operating expenses, 10 cts. goes for the everyday work on the sections. In the same way, out of every dollar spent on maintenance-of-way, from 50 to 75 cts. go for this everyday work. This includes repairs to roadway, fences, cattleguards, signs, crossings, etc., but does not include renewals of rails and ties. The total cost of maintenance-of-way, not including bridges and structures, ranges from $600 to $3,500 per mile each year. As a rule, there is very little visible result of the expenditure for ordinary maintenance. At the end of each year the track is in about the same condition as at the end of the previous year, and most of the money and work has gone to keep the track in fair condition.

The increase in strength and stability of track follows far behind the increase in weight of locomotives and cars. In fact, one of the most difficult problems is the maintenance-of-way on a road where the conditions include light rails and scanty ballast, heavy locomotives, fast trains, heavy traffic, and a limited allowance for the maintenance-of-way department.

Some 20 or 25 years ago, the expenses for maintenance and renewal of track and structures averaged about 25%

*Abstract of an address delivered at the annual meeting of the Roadmasters and Maintenance-of-Way Association, held at Milwaukee, Wis., Nov. 10 to 12.

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of the operating expenses, but the percentage was diminishing. This reduction was due largely to the longer life of steel rails as compared with iron rails. It was not only in the lower cost of rail renewals, but also in such other related matters as the spike killing of ties and the general disturbance of the track which increases when rail and tie renewals are frequent. It seemed at that time that the maintenance expense would be reduced still further, as the steel-rail tracks when once put in good condition would require less work than the iron-rail tracks. The introduction of extremely heavy engines and cars (especially the engines), has put a new face on the matter. Even with good steel rails it is sometimes a difficult matter to maintain the track in reasonably good and safe condition under the influences of the tremendous weights which it is required to carry.

The only remedy is to use heavier rails of better quality, with improved joints and fastenings, better tie supports, and a heavier bed of first-class ballast. In this way the proper relation may be restored between the track structure and the train loads which it carries. But to do this, the cost of maintenance and renewals must of necessity be greatly increased for a time.

The cost of maintenance-of-way increases necessarily with an increase in the number of trains. It was pointed out by the late A. M. Wellington that a continually advancing standard of maintenance is indispensable as the volume of traffic increases, and he estimated that the cost of each step towards perfection increases about as the square of the number of steps. A very slight expenditure suffices to maintain track in condition to carry one train per day. A slight additional expenditure suffices for two or three trains per day, and makes a great improvement in the condition of the track. With a traffic of 40 to 50 trains a day, a very large additional expenditure will be found necessary, or at least expedient; but the visible improvement will be very small.

The rails, ties and ballast are the three principal elements in track construction. Only those with experience in the maintenance department can realize the amount of work spent every week, month and year in keeping the rail fastenings secure. The spikes work loose and have to be driven home, the spike holes are enlarged by wear and decay, so that the spikes have to be drawn, holes plugged, and spikes redriven. This is a constant and continual work, without end and without any permanent result. The rail joint is another matter needing continual attention. Bolts work loose, splice bars bend, and the joints get low.

At curves, the fastenings to the ties are particularly deficient, in consequence of the severe and irregular stresses to which they are subjected by the lateral pressures of the wheel flanges against the rails. Tie-plates help somewhat, especially when provided with a shoulder to fit the edge of the rail. On the Pennsylvania lines it has been suggested that the outer rail of a curve should be laid on tie-plates having each a deep rib resting in a groove cut across the face of the tie. In this way the lateral pressure on the rail is resisted by the tie. This was actually practiced in Europe several years ago. The same result is accomplished in some steel ties used extensively in Germany, where the tie-plate has a lug engaging with a hole in the tie. Thus the tie and tie-plate are mechanically locked together, and help the bolt in resisting the pressure. Ordinarily, however, the entire pressure is taken by the spike and the small area of wood against its back.

But this is not all, there are switches, frogs and turnouts every few miles. These have numerous fixed and working parts, and operating mechanism, all to be inspected and kept in condition. Track crossings are less frequent but add to the general total. Again, there are numerous important accessory features. Ditches must be trimmed and cleaned to drain the roadbed. Road crossings and cattleguards, fences and signs must all be attended to. Then the road must be kept in good appearance by occasional policing. Weeds, grass and brush cut, ballast trimmed, and a general appearance of neatness maintained. All of this is included in "maintenance-of-way."

The problem of getting and maintaining competent section men and section foremen is a very serious and practical problem for the man in charge of the work of maintenance-of-way.

Some roads have special gangs for the training of foremen, and this is a wise policy.

Extra or floating gangs are sometimes employed for such work as fencing, renewing rails, putting in switches, ballasting, ditching, tile drainage, and general surfacing. Where a good class of labor is employed it is well to have all ordinary work done by the regular gang, and a good foreman and gang should be able to do ordinary switch work. The frequent appearance of the floating gang is apt to put the regular gang in the habit of expecting to avoid heavy or special work. With the inferior labor now often employed, the conditions are somewhat different, and it has been suggested that it would be economical to maintain a floating gang of good men, provided with a comfortable boarding train and paid good wages.

A system employed successfully by Mr. C. E. Bryan, some time ago, on the Ohio River Ry., provided for permanent floating gangs, each consisting of 20 men and having charge of 30 miles of line. This left only the lighter class of work to the section gangs. The sections were 8 miles long, and each had a gang of four men (including the foreman). The gangs went over their sections daily (the trackwalker being dispensed with); they inspected the track, made light repairs, fixed fences, kept station grounds neat, etc. This had the advantage that the inspection was done under the eye of the foreman, and repairs could be made at once. The floating gangs did all such work as ballasting, renewing ties and rails, widening banks, ditching, etc. Under this system, the work of renewing rails, ballast and ties was carried on in 1900 without any increase in forces such as would have been required under the ordinary system. Each division was able to do all this work on about 8 to 10 miles per month.

One good way to forward the education of the foreman is to let him see what other foremen are doing. It is to be wished that more railways would follow the practice of holding an annual inspection of track, and taking all the foremen of a division over the entire division.

SERVICE TEST OF THE STEAMSHIP "HARVARD."*

By PROF. C. H. PEABODY,† PROF. W. S. LELAND,† and MR. H. A. EVERETT.†

The attention of members is particularly called to the fact that this test was run under the conditions obtaining in actual service, no attempt having been made to approximate the ideal conditions existing on the usual trial-trip runs. We are much indebted to Mr. R. McGregor, General Superintendent of the Metropolitan Steamship Co., for the personal interest he manifested in the test and for the assistance he freely gave.

Observations were taken by Messrs. Young, Fisher, Hubbard and Davis, students of the Mechanical Engineering Department of the Massachusetts Institute of Technology, for thesis work; but the test was made under the direction of the Department of Naval Architecture and under the personal supervision of the authors. The results reported were computed by assistants in the Naval Architecture Department.

The engine test began at 9 p. m. when the engine had reached full power, and was stopped at 3 a. m. as we approached Nantucket Shoals. The last reading was taken at 2.55, when the first half-speed bell sounded, and the curves exterpolated to 3 o'clock. The boiler test was begun at 7.10 p. m. and continued until 7 o'clock the next morning, the curves being exterpolated to make 12 hours. Pressures were read, as far as possible, on the engine-room gages, which were tested for the occasion by the Crosby Steam Gage & Valve Co. Where engine-room gages were not available, gages tested at our own laboratories were used.

The horse-power was determined by means of the Denny & Johnson torsion meter, belonging to the Department of Naval Architecture at the Institute of Technology. The inductors were so set as to give a clear length of shaft between inductors of 63.06 ft. on center shaft, 47.52 ft. starboard, and 49.21 ft. port, which gave readings of approximately 95, 75 and 70 respectively at full power.

Inductors were set on all three shafts, but during the test the port recorder failed to work at the end of two hours, due to a rupture of the connections. From the few readings thus obtained, and from readings taken on a preliminary run, when it did work satisfactorily, it appears that the torque readings on this shaft were 93% of those on the starboard, and in computing the horse-power this figure has been taken. This, of course, throws some little uncertainty into the calculation, but there is every reason to believe that the assumption is very nearly correct. It would take practically 3% error on this shaft to affect the total horse-power by so much as 1%. The torsion meter can be read only to single units, so that this of itself means an uncertainty in the last digit which corresponds to an inaccuracy of about 1¼%. When, however, the readings are plotted at 10-minute intervals, as is here done, and the results faired, the probable error is likely to be much less.

In computing the horse-power, 1.506 based on a torsional modulus of elasticity of 11,600,000 was used for the constant K in the formula

$$HP. = \frac{K d^4 r R}{C L},$$

in which d = the diameter of the shaft in inches (8 ins.), r = torsion meter reading, R = revolutions per minute, C = inductor constant (12.5), L = length of shaft in feet between inductors.

The shaft was not twisted to determine the exact constant, but since 11,600,000 is the mean of a large number of tests it cannot be far from right. We find 11 million and 12 million to be practically the minimum and maximum values, showing a variation of about 3% only in extreme cases. That the actual modulus of the Harvard's shaft should vary from the mean value by more than 1½% is extremely improbable. All in all, taking into account the uncertainty of the short shaft, there is every reason to believe that the horse-power is subject to an error less than that of the ordinary steam-engine indicator.

The water consumption was measured by a 6-in. Hersey hot-water meter loaned by the Hersey Manufacturing Co., of South Boston. It was installed in the suction line between the hot well and the feed pumps and gave exceedingly satisfactory results. This meter was previously calibrated by the Hersey Co. and indicated an under-run of 1% under the conditions of the test. The curve of meter readings was plotted without this correction, so that 1% should be added to any ordinate of that curve to get the correct reading.

Steam for all the auxiliaries excepting the blowers came through the starboard pipe only, in which a thin plate having a 2½-in. orifice was inserted. The valve on the port line was tightly closed and the by-pass around the reducing valve on the auxiliary line opened so that all the reduction in pressure was due to the orifice. The reduced pressures were read on the auxiliary steam gage on the engine-room gage-board and the flow of steam computed from coefficients determined by experiments made at our engineering laboratories. An independent orifice was necessary for the blower engines as this steam did not come from the auxiliary line.

The probable error in determining the auxiliary steam is small. The gage pressures were read to the nearest pound every 10 minutes and the average must be very nearly right. An error of 1 lb. in this average would mean about 2% error in the total auxiliary steam, but even if the error here was four times as great it would be of small moment, for the auxiliary steam is only about 13½% of the total.

The coal was determined by counting the buckets dumped on the floor. The average net weight of coal was 506 lbs. per bucket. Such a method as this for coal determination is open to question, but is perhaps the best that can be adopted on a short sea run. Even had the coal been weighed, the different condition of the fires at start and finish might have been considerable in so short a run. There is every reason to believe that any determination for so short a run would be somewhat too small. Our figures seem to show 80 tons for 12 hours equal to 100 tons for 15 hours, the running time from dock to dock, and this figure checks remarkably well with the amount of coal actually placed on board, an average being taken over a large number of trips.

The quality of steam was determined by the throttling calorimeter, the sample being taken from a tee on the top of the steam main, inserted for this purpose where the pipe was tapped for the gage connection.

The accompanying table gives the summary of the results and the principal dimensions of the vessel.

Dimensions:	
Length between perpendiculars	386 ft. 6 in.
Breadth of hull molded	50 ft. 6 in.
Breadth over guards	63 ft.
Depth molded	22 ft.
Draught normal	16 ft.
Draught at trial (mean New York to Boston)	16 ft. 2 in.
Results of Boiler Test:	
Date of test	June 25, 1908.
Duration of test	12 hours.
Boiler pressure average gage	137.8 lbs.
Quality of steam	95.9
Barometer	29.97 in.
Temperature of feed water	203.5° F.
Draught at blowers (Howden)	1.71 in.
Number of boilers (single-ended Scotch).	12
Total grate area	756 sq. ft.
Total heating surface	20,520 sq. ft.
Ratio heating to grate area	38.6
Total coal fired in 12 hours	179,112 lbs.
Total water fed in 12 hours	2,041,710 lbs.
Equivalent evaporation from and at 212° per lbs. of coal	11.2
Coal per sq. ft. grate	19.6
Heating value of coal	14,510 B.T.U.
Results of Engine Test:	
Type of engine	Parson's turbine.
Duration of test	6 hours.
High-pressure gage	124.4 lbs.
Low-pressure gage, average S. & P.	21.3 lbs.
Vacuum (average S. & P.)	27.42 in.
Temperature of injection water	63.5° F.
Temperature of discharge water	107° F.
Temperature of hot well	110.8° F.
Total water per hour during test	176,010
Maximum revolutions	p. 468, c. 472, s. 472.
Minimum revolutions	p. 433, c. 444, s. 441.
Average revolutions (6 hrs.)	455
Maximum shaft HP.	11,076
Minimum shaft HP.	9,525
Average shaft HP. (6 hrs.)	10,405
Steam for auxiliaries per hr.	22,380 lbs.
*Steam per shaft HP. per hr., all purposes	16.9 lbs.
*Steam per shaft HP. per hr, turbines only	14.76 lbs.
B. T. U. per shaft HP. per minute	265.9
Coal per shaft HP. (av. of 6 hrs.)	1.5 lbs.

*Uncorrected for 4% priming.

*A paper read at the sixteenth general meeting of the Society of Naval Architects and Marine Engineers, New York, Nov. 19 and 20, 1908.

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[It is fair to state that this paper was strongly criticised by Mr. G. H. Barrus, M. Am. Soc. M. E., as not being a reasonably accurate test. His criticism was based on the contentions that, (1) coal consumption by buckets was utterly unreliable, (2) condition of fires at start and finish were not accounted, (3) the use of hot-water meters was not acceptable, (4) the torsion method of determining shaft horse-power was not generally accepted, (5) 11.2 lbs. water equivalent evaporation was impossibly high, (6) the arithmetical work was not correct and the data given should yield 11.53 lbs. water equivalent evaporation. (7) flue gases, draft, etc., should have been determined.

It is also fair to state that the authors explained the conditions under which the test was run, the necessity of certain inaccuracies and their magnitude. Prof. Peabody expressed the opinion that the results were correct within 2 or 3%, but that they might easily be wrong by more than 5%. The average coal rate found as a result of the test (6.66 tons per hr.) agreed well with the average coal burned per hour on 178 trips (7.4 tons per hr.)—Ed.]

NOTES FROM ENGINEERING SCHOOLS.

UNIVERSITY OF WISCONSIN.—The College of Engineering is giving this fall for the first time a complete course in the practical details of mining engineering. It is planned to further increase the facilities of the college in this direction by the installation of additional laboratory equipment, including ore dressing apparatus.

UNIVERSITY OF VERMONT.—A Department of Teaching was formally instituted at the University of Vermont, Burlington, Vt., on Nov. 11. This department has grown out of the demand in this part of New England for the better training of teachers in preparatory schools and colleges. Teachers' conventions and special short-term courses for teachers, held under the auspices of the university, have been relied upon to fill the demand. It is proposed to give attention to the training of teachers in "mechanics, arts and agriculture." For the present year the work will be handled by the faculty of the arts and science departments, but special chairs will probably be established in the next year. Prof. L. R. Jones has been appointed Dean of the new department.

NORTHWESTERN UNIVERSITY.—Construction of the new Swift Hall of Engineering on the campus at Evanston, Ill., is proceeding rapidly and will be completed during the coming winter. It will cost about $100,000, aside from equipment and furnishing. The formal dedication will probably occur in June, 1909.

Up to the present, Northwestern University has had no School of Engineering. This newly established department will provide instruction in civil, mechanical and electrical engineering. It is proposed to maintain this new school in close cooperation with the College of Liberal Arts. The distinctive feature of this school will be that its courses will extend over five years and no engineering degree whatever will be given for less than a five-year course. The courses will include a greater number of non-technical studies than commonly prescribed, and these will be selected to furnish general education and to develop powers of independent thought. In the technical instruction greater emphasis will be placed on the fundamental studies forming the basis of all engineering courses than on the special lines.

Mr. John F. Hayford, of the Coast and Geodetic Survey, Washington, D. C., is the Director-elect of the school.

THE GOLD ST. SEWER CAVE-IN in Brooklyn, N. Y., described in our issue of Nov. 26, p. 598, caused the death of 12 persons. There were taken from the hole the bodies of eight laborers, one city inspector, two children and one man who lost his life in saving a woman from being carried into the slip. The last body, that of the inspector, was not found until a week after the accident, though the work of rescue was carried on continuously throughout all that time. No official investigation into the cause of the collapse has been completed.

A SEWER CAVE-IN, somewhat similar to the one noted above, occurred in the excavation of the Niagara St. subway under the Grand Trunk R. R., in Buffalo, N. Y., on Nov. 24. A gang of men were removing braces preparatory to the entrance of a steam shovel, which was to lower the grade, when the walls collapsed, catching six men in the cave-in. One man of the six was killed, but the others escaped serious injury.

AN ACCIDENT IN A SALT MINE at Oakwood, Mich., on the western outskirts of Detroit, Nov. 28, resulted in the death of six men. They were at work about 500 ft. below the surface in a shaft belonging to the Detroit Salt Co. In some way the supply of air was interrupted and the men were overcome by hydrogen sulphide before they could be hoisted to the surface. Three of the six men fell from the hoist and up to Nov. 30 their bodies had not been recovered from the well of sulphur water at the bottom of the shaft.

THREE STEAMSHIP ACCIDENTS occurred this week in which about 200 lives have been lost. The "Sardinia" a British steamer of the Ellerman Line, sailing from Liverpool to Alexandria, was destroyed by fire Nov. 25 within sight of Valetta, Island of Malta. The fire spread so rapidly as to render useless the efforts to get it under control and destroyed the ship's boats. There were about 250 people on board, of whom 200 were Arab pilgrims. Many were rescued by boats from Valetta, but it is estimated that more than 100 were drowned.

The "Finance" of the Panama Line, bound for Cristobal in the Canal Zone, was struck Nov. 26 by the steel freighter "Georgic" of the White Star Line near Sandy Hook. The "Finance" sank within ten minutes after the collision and four of those on board were drowned. The remainder of the 150 people aboard the "Finance" at the time of the collision were rescued by the boats of the "Georgic," which was not much damaged. The accident was due to a heavy fog.

The "Ponting," a coasting steamer of the Philippine Islands, was wrecked during a storm Nov. 27 on the coast of Luzon, near San Fernando. A large number of rice-field laborers were on board, and it is estimated that about 100 were drowned.

RAILWAY ACCIDENTS occurring between Nov. 24 and 30, in the United States, caused the death of eleven persons and the serious injury of about 30 others. A Broadway street car in Cleveland, O., ran into the rear of an Akron, Bedford & Cleveland interurban car Nov. 24. Eight men on the street car were injured, one fatally. The Broadway car was following close behind the interurban car, both running at a high rate of speed, when the interurban upon striking an upgrade came to a stop and the following car crashed into it and was completely wrecked. The heavier car was also damaged but none of its passengers were hurt.

A rear-end collision between two local passenger trains occurred Nov. 28 at the South Boston station of the New York, New Haven & Hartford R. R. One man was killed and about 15 others were seriously injured, one of them dying two days after the accident. One of the trains had stopped at the South Boston station when the second train came around the wide curve under the Dover St. bridge and crashed into the rear coach, which was completely wrecked. The yards are thoroughly equipped with the block signal system and, although there had been a shifting of trains on account of a slight wreck on the Plymouth division, this does not seem to adequately explain the accident. Either the signals did not operate correctly or the engineer of the second train must have run by a signal set at "danger."

The "Chicago Limited" on the Pittsburg & Western branch of the Baltimore & Ohio R. R., was wrecked near Valencia, Pa., Nov. 30 The fireman was killed and five others were seriously injured. The accident was due to the "buckling" of a freight train, one car of which was forced out onto the track just ahead of the limited train.

The boiler of a freight locomotive on the Missouri, Kansas & Texas Ry. exploded Nov. 27 near Idenbro, Kan., killing the engineer and fireman and seriously injuring the brakeman. The locomotive had just been overhauled in the railway shops.

A head-on collision on the Seaboard Air Line Ry. near Ocala, Fla., Nov. 28, resulted in the death of five persons and the injury of three others.

The evening express train on the Chinan Fu & Tsing Tau R. R. was derailed Nov. 23 on a bridge near Nunkouyu, China, while running at high speed. The locomotive and some of the forward coaches plunged into the river and the bridge was heavily damaged. Sixteen passengers were killed and many others injured.

A FLOOD IN GUTHRIE, OKLA., Nov. 29, inundated several hundred homes in West Guthrie, stopped all street car service and destroyed an immense amount of property. The flood is ascribed to a heavy downpour of rain which lasted 48 hours in the valley of the Cottonwood River and its tributaries. Thousands of bales of cotton were carried off downstream and a large number of cattle were drowned. The city water-works were reported as being under water, as were also the Topeka, Atchison & Santa Fe roundhouse and shops.

A POWDER MILL EXPLOSION in South Acton, Mass., Nov. 28, completely wrecked the No. 7 mill of the American Powder Co.'s plant. No lives were lost.

A LEAK IN A GAS MAIN at Paterson, N. J., Nov. 26, resulted in the death of two persons and the injury of six others. The broken gas main flooded many cellars and dwellings in Newark Ave. and Sussex St. Three men were seriously burned by an explosion which followed their efforts to find the leak. Three children were injured by inhaling the gas and one man and woman were asphyxiated.

A VERY SERIOUS DISASTER OCCURRED at the Rachel and Agnes mines of the Pittsburg-Buffalo Coal Co., at Marianna, Pa., Nov. 28. An explosion occurred shortly before noon when there were about 140 men in the mines, and reports of Dec. 1 state that 124 bodies had been recovered up to that time. Only one man who was in the mine at the time of the explosion was taken out alive. The Marianna mines are claimed to have been among the best equipped coal mines in the country and it is stated that every effort had been made by the owners to secure the safety of the miners. The Rachel and Agnes mines were connected by underground galleries and were practically one mine. At the time of the explosion the Deupty State Mine Inspector had just completed a two days' inspection which revealed no cause for apprehension. The inspector had just come to the surface and the cage had started back down the shaft carrying a foreman and two miners when the explosion occurred. The cage was blown up through the roof of the shaft house, portions of which were found at a distance of 2,000 ft. from the shaft. In addition to the three men in the cage, portions of two other bodies were blown from the shaft. A dense volume of smoke issued from the shaft immediately after the explosion but soon diminished and rescue parties made efforts to enter. The ventilating fans had been injured by the explosion and for several hours no air could be forced into the mine, and the attempted rescue work was further impeded by the obstruction of the shaft with shattered timber and other debris forced into it by the explosion. It was not until about nine hours after the explosion that an effective exploration of the mine was begun by a rescue party equipped with safety helmets. It is reported that a small fire broke out in the mine Nov. 29 but was quickly extinguished.

The mine is claimed to have been kept so thoroughly sprinkled that a dust explosion was impossible. The only hypothesis advanced as to the cause of the explosion is that a large pocket of natural gas was broken into by mining operations. The fact that there is a gas well in close proximity to the mine strengthens this theory.

ACID TREATMENT FOR CONCRETE SIDEWALKS is being practised by the South Park Commission of Chicago. The process is that invented by H. S. Richards and the late Wm. Black (Superintendent and Engineer, respectively, to the commission), and extensively used on the park buildings. It consists in washing the surface with a solution of muriatic acid in order to remove the skin of cement and expose the aggregate, thus giving a rough or granular finish. This prevents the slipperiness which is so often an objectionable feature of concrete walks, owing to the tendency of the sidewalk makers to float the surface in such a way as to form a skin coat of cement. This may be avoided by the use of coarse hard aggregate in the surface and a proper method of floating; or by treating the surface in the manner noted above. The acid treatment has been used recently on the new 25-ft. sidewalk on the Grant Park side of Michigan Ave., which avenue is to be widened next spring from Jackson Boulevard to the south side of Grant Park by the removal of the present sidewalk. The new walk was built in separate slabs 8 ft. 4 ins. square, and 5 ins. thick, on a 12-in. cinder foundation. The lower portion (4½ ins.) is a 1:2:4 mixture, using ¾-in. crushed limestone. The ¾-in. top course is composed of one part Portland cement to 2½ parts of red granite screenings. When this has set, it is washed with the acid solution and then with water. This removes the cement skin, shows the color of the aggregate, and leaves a roughened surface. The work was done by the force of the South Park Commission, under the direction of Mr. Linn White, Engineer of the Commission.

THE LARGEST CONCRETE ARCH BRIDGE in the world is the highway bridge over the Gmünder-tobel on the cantonal road from Teufen to Stein in Canton Appenzell, Switzerland, recently completed. It comprises a central arch of 259¼ ft. clear span (27 ft. longer than the span of the Walnut Lane bridge in Philadelphia), and six 33-ft. arches in the approaches. The roadway

is supported by rows of columns resting on the arch. The abutments and piers are of plain concrete, while arch columns, roadway plate and balustrade are reinforced. The design was made by Prof. E. Mörsch, while Mr. A. Sutter was the engineer in charge of erection. The bridge was opened to traffic on Nov. 7, 1908.

AN ARCHITECTURAL PRIZE COMPETITION, in which the subject is a suburban concrete residence, is to be opened Dec. 17 by the Chicago Architectural Club. Three prizes, offered by the Universal Portland Cement Co., will be awarded, $200 for the best design, $75 for the next best and $25 for the third best. By the rules of the contest, the competition is open only to persons residing within a radius of 50 miles from Chicago, and the drawings are to become the property of the company donating the prizes. The building is to be on a suburban lot, 100 x 250 ft., is to contain at least 8 rooms and two baths, must be constructed in foundations and walls, of concrete, plain, reinforced or in blocks, and in the floors of reinforced concrete. If concrete blocks are used the rock-faced type are prohibited. Further particulars of the competition may be obtained from the club, 84 Adams St., Chicago.

THE PHENOMENAL DROUGHT has continued during November throughout the entire section east of the Mississippi River. While there are no crops to be injured at this season, the steady drafts on the reservoirs have brought many cities and towns to the verge of a water famine and in some the regular supply has been absolutely exhausted, and water is hauled by tank cars to supply urgent necessities. Many cities are making plans for the installation of temporary emergency supplies from sources that would not be considered at ordinary seasons on account of pollution. Railway companies have in many cases been notified that their drafts of water for locomotives would have to give way to the needs of domestic consumers and they have in consequence been hastily installing emergency supplies. New York City has drawn down its reserves in the Croton water shed to about 44,000,000,000 gallons. The New York Central Ry. Co. is said to have installed its own plant by which it can take care of its locomotives in the New York yards by supplies brought in on tank cars in case of necessity.

While the city water supplies attract most attention, an enormous aggregate of inconvenience and loss is being experienced by the dwellers on farms and in small villages throughout the country. The water supplies of most such places are from underground sources feeding wells and springs. These have generally failed from the long drought, and with the approach of severe winter weather those underground streams are not likely to be renewed until the melting of the snowfall in the spring.

In contrast with these conditions are those in the Southwest, where copious rains have produced serious floods in southern Missouri, Arkansas and Oklahoma.

AN ACCIDENT IN THE MUNICIPAL LIGHTING plant at Frankfort, Ind., on Oct. 28, wrecked the engine and generator. The installation of a new unit was effected with remarkably little delay by the Allis-Chalmers Co., which has furnished us with the following information as to the proceedings:

On the following morning (Oct. 29), in response to a telegram, a sales-engineer attached to the Chicago office of the company was on the ground and had submitted a proposal for a steam turbine and generator of 500 KW. capacity to operate at 3,600 r.p.m. and deliver two-phase, 60-cycle current at a terminal pressure of 2,300 volts. The contract was signed at a late hour that same day, and specified shipment of the unit within six days from that hour. The contract was at once taken to the West Allis works of the company, near Milwaukee, being delivered there at 2.30 p. m., on Oct. 30.

For the steam end of this unit, a turbine then nearly complete in the shop was selected, and the finishing work upon it was rushed. There was, however, no turbo-generator available designed for the frequency, phase and voltage required. Consequently, one had to be entirely wound. Notwithstanding this, the generating unit complete in every detail was shipped by express at 11 a. m., Nov. 3 (in a car built specially for automobiles), and arrived in Frankfort at 3 a. m. of Wednesday, Nov. 4.

By Sunday morning, Nov. 8, the unit had been completely installed and connected to its auxiliaries. During that day the generator coils were baked out, as is necessary before a machine can be started. The next morning, Nov. 9, the unit was in regular operation and carrying the station load, precisely 13 days from the time the original engine had been wrecked.

THE WASHINGTON ST. TUNNEL in Boston was opened for official inspection on Monday, Nov. 23. A party of some 900 invited guests were carried through the tunnel in special trains, stopping at each station for inspection. The tunnel is about two miles in length and runs in general through the center of the business district, parallel with the older Tremont St. subway. It is intended to use it chiefly for elevated railway trains, leaving the Tremont St. subway for the use of the street surface cars, as originally planned and as practised during the first years of its use. The construction of the Washington St. subway has involved great difficulties, on account of the narrow streets and high buildings along the route. The engineers have been successful, however, in securing direct alinement, and the new subway is claimed to be superior in finish and execution to anything heretofore constructed.

THE FLOW OF SEWAGE INTO THE DELAWARE River at Camden, N. J., is to be stopped, according to an order issued by the New Jersey State Board of Health. The board has notified the city of Camden that it must cease discharging its sewage into the Delaware, notwithstanding the fact that all the sewage of Philadelphia, which lies on the other side of the river, is discharged into that stream. The position of the State Board of Health is particularly notable, because at the opposite side of the State, New Jersey is in conflict with New York regarding the discharge of sewage from the Passaic Valley towns into New York Harbor. There is, however, the notable difference that New York Harbor is actually an arm of the sea, whereas the Delaware River at Camden is a long way above the head of Delaware Bay.

PERSONALS.

Mr. J. B. Cozart, Division Master Mechanic of the Mexican Ry. at Apizaco, has resigned to take a similar position with the Pan-American R. R.

Mr. E. B. John, Supervisor of the Pennsylvania R. R. at Altoona, Pa., has become Assistant Engineer of the Delaware Division with headquarters at Wilmington.

Mr. R. D. Smith has been appointed district master mechanic of the Canadian Pacific Ry., at Medicine Hat, Sask. He was formerly a road foreman for the same company.

Mr. W. W. Wheatly, at one time General Superintendent of the Brooklyn Rapid Transit Co., has been elected Vice-President and General Manager of the Metropolitan Street Ry. Co., of Kansas City, Mo.

Mr. J. J. Clarke, Chief Train Dispatcher of the Mexican Ry., has become Superintendent of Transportation succeeding Mr. E. M. Wise, who resigned to take a position with the Pan-American R. R.

Mr. Arthur Hale, General Superintendent of Transportation of the Baltimore & Ohio R. R., has resigned to become the permanent chairman of the car-service department of the American Railway Association.

Mr. Charles B. Rodgers, Superintendent of the Chicago, Burlington & Quincy R. R. at Wymore, Neb., has been appointed General Manager of the St. Louis, Brownsville & Mexico R. R. with headquarters at Kingsville, Tex.

Mr. H. E. Hutchens, General Superintendent of the Southern Ry., at Birmingham, Ala., has been elected President of the Birmingham Traffic Association Co., which has been formed for the purpose of promoting better relations between the trunk lines entering Birmingham.

Mr. Joseph A. MacLennan has resigned his position at the Philadelphia works of the Link-Belt Co. to become President of the Wilmot Machinery Co., of New Orleans, La. He has been associated with the Link-Belt Co. for over twelve years, during part of which time he was Chief Engineer of Woodward, Wight & Co., its New Orleans agents.

Mr. F. B. Maltby, M. Am. Soc. C. E., sailed for Panama Nov. 28 to take personal charge of the erection of the cable-way plant being built by the Lidgerwood Mfg. Co. for handling the material used in constructing the locks at Gatun. There will be 13 cable-ways of 800 ft. span designed for six-ton loads and supported on traveling steel towers 85 ft. high.

Mr. Robert J. Thomas, as announced in our Engineering Societies' column, Nov. 5, has been nominated as the next President of the New England Water-Works Association. Mr. Thomas was born in Lowell, Mass., July 21, 1856, and was educated in the public schools of that city. Two years of his boyhood were spent in St. John, N. B., while his father was engaged in construction work on the Intercolonial Ry. In 1881 he became a member of Lowell Common Council and was a member of the Board of Aldermen in 1883 and '84, being elected Chairman of the Board in 1884. He was also a member of the Committee on Roads and Bridges during the construction of the Aiken St. and Central bridges across the Merrimack River. In 1886 he became Superintendent of the Lowell Water-Works and has held that position from that time on, with the exception of two years when he traveled throughout the country selling water-works supplies. Mr. Thomas is a member of the American Water-Works Association and has been for seven years Advertising Agent of the New England Water-Works Association.

Obituary.

William J. Leake, formerly President of the Richmond, Fredericksburg & Potomac R. R., died at his home in Richmond, Va., Nov. 23.

James J. Duffy, an excavating contractor of New York City, was killed Nov. 23 by falling down an air-shaft while inspecting his stable on 24th St.

William Brennan, who was a deputy ... sioner of Brooklyn, N. Y., from 1898 to 19... 23 at his home in that city. He was 52 ye...

James Goodwin, Manager for ten years ... Transit & Light Co., of Bakersfield, Cal., ... home in that city Nov. 15 after a two week...

Bernard Haning, employed by the C. L... struction Co., of St. Louis, Mo., as a ... of construction, died at St. Louis, Nov. 25, ... poisoning. He was 23 years old and was ... his illness, in superintending the construction ... Salle buildings in St. Louis.

William Henry Jackson, President of ... Architectural Iron Works, died Nov. 24 at ... Madison Ave., New York City. He was ... York in 1829 and was a member of the ... Chamber of Commerce and of the General So... chanics and Tradesmen of New York City.

Alfred Marsh, geologist, chemist and invent... Kalamazoo, Mich., Nov. 16. He was born ... England, in 1819 and came to New York whi... man. He was for some time employed by th... tan Gas Co. and invented a gas meter of the ... common use. Later he removed to Detroit, Mi... he worked as a chemist for the Detroit & Lak... Copper Co.

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 15-17. Annual convention at Washington, D. C. Secy., Glenn Brown, "The Octagon," Washington, D. C.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
Dec. 28-29. Annual meeting at Pittsburg, Pa. Secy., John C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

NATIONAL ASSOCIATION OF CEMENT USERS.
Jan. 11-16. Annual convention at Cleveland, Ohio. Secy., Geo. C. Wright, Harrison Bldg., Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
Jan. 19. Annual meeting at New York City. Secy., W. M. Mackay, P. O. Box 1818, New York City.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 28. Annual meeting at Toronto. Secy., C. H. McLeod, 413 Dorchester St., W., Montreal, P. Q.

NEW YORK RAILWAY CLUB.—At the annual meeting held at the Engineering Societies Bldg. in New York City, Nov. 20, the following officers were elected for the ensuing year: President, John F. Deems, New York Central Lines; Vice-Presidents, W. G. Besler, Central R. R. of New Jersey, H. S. Hayward, Pennsylvania R. R., Frank Hedley, Interborough Rapid Transit Co.; Treasurer, R. M. Dixon, Safety Car Heating & Lighting Co.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The December meeting will be held at Hotel Brunswick, Boston, Mass., Dec. 9. The following papers will be presented: "Wrought Iron Cement Lined Water Pipe," Leonard Metcalf, Boston, Mass.; "Newton (New Jersey) Water-Works, with Special Relationship to the Storage and Diversion Features and Legal Proceedings Growing Therefrom," Louis L. Tribus, New York City; "Informal Description of the Water-Works of Havana, Cuba," Bertram Brewer, Waltham, Mass.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—The inaugural meeting was held at Chicago, Ill., Nov. 21, 40 railways being represented. It is the object of this association to discuss and improve methods of inspection, handling and economical use of fuel. Officers were elected as follows: President, Eugene McAuliffe, Chicago, Rock Island & Pacific Ry.; First Vice-President, Thomas Britt, Canadian Pacific Ry.; Second Vice-President, C. R. Ingersoll, Lake Shore & Michigan Southern Ry.; Treasurer, J. McManamy, Pere Marquette R. R.; Secretary, D. B. Sebastian, Chicago & Eastern Illinois R. R. The first annual meeting will be held in June, 1909.

NATIONAL ASSOCIATION OF CEMENT USERS.—The Committee on Art and Architecture requests parties who are designing or constructing work in (1) Monolithic and reinforced-concrete residences, (2) factories and office buildings, (3) bridges, walls and fences, (4) interior decoration, (5) concrete block construction, and (6) manufactured stone, to send to Mr. Alfred Moyer, Flatiron Building, New York City, photographs and a description of the work with its method of construction and, if possible, the costs. These photographs will be classified by the committee, and two of the most artistic designs of each class will be selected and used as illustrations in the printed volume of the annual proceedings. Several copies of the latter will be sent, gratis, to the party who executed the work and furnished the photographs. The remainder of the designs and photographs which may have proper artistic value will be illustrated by lantern in the Committee's annual report which will be presented at the Cleveland meeting of the Association, Jan. 11 to 16, 1909.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, December 3, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work.	Place.	See issue.
12- 4	Earth dam,	Springfield, Mass.	
		(S.)	11-12
12- 9	Dredging,	Savannah, Ga. (S.)	11-12
12- 9	Dredging,	Boston, Mass. (S.)	11-12
12-12	Pile pier,	Mich. City, Ind. (S.)	11-12
12-14	Bridge,	Green Bay, Wis. (P. & S.)	11-19
12-14	Steel tank and tower,	Gridley, Cal. (S.)	11-19

LIST OF CONTRACTS PENDING.

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12- 7 Power equipment, etc, N. Y.....11-26
12- 7 Light and heat, etc., N. Y.....11-26
12-10 Motors, New York.....12- 3
12-10 Equipment, Dayton, Ohio.....12- 3
12-11*Lighting, Rutherford, N. J.....12- 3
12-11 Power-house, Cincinnati, Ohio..11-19
12-15 Gas producer plant, Fernie, B. C.12- 3
12-16 Power plant, Agnew, Cal.....11-26
12-22 Light system, Jefferson Barracks, Mo.....12- 3
12-28*Power plant, etc., Winnipeg, Man.12- 3
1- 4 Lighting, Hartford, Conn.....11-12

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12- 3 Bridges, Rochester, N. Y.....11-26
12- 3 Bridge, Spartanburg, S. C.....12- 3
12- 4 Bridge, Milwaukee, Wis.....12- 3
12- 5 Bridges, Wichita, Kan.....11-26
12- 7 Bridges, Valparaiso, Ind.....11-26
12- 7 Bridges, Vicksburg, Miss.....11-26
12- 7 Bridge, Gulfport, Miss.....11-26
12- 7*Viaduct, Kansas City, Mo.....11-12
12- 7 Bridge, Grenada, Miss.....10-29
12- 7 Bridge, Kingfisher, Okla.....12- 3
12- 7 Bridge, Crookston, Minn.....12- 3
12- 7 Bridge, Greenwood, Miss.....12- 3
12- 7 Bridge, Los Angeles, Cal.....12- 3
12- 8 Bridges, Pawhuska, Okla.....12- 3
12- 8 Bridge, etc., Paoli, Ind.....12- 3
12- 8 Bridges, Princeton, Ind.....11-12
12- 9*Bridge, etc., Mamaroneck, N. Y..11-26
12-14*Bridge, Green Bay, Wis.....11-19
12-15*Bridge, Bridgeport, Conn.....12- 3
12-16 Substructure, etc., Columbus, O.11-12
12-18 Bridge, Cincinnati, Ohio.....12- 3
12-21 Bridge, Morrisville, Pa.....12- 3
12-24 Bridge, Sumner, Wash.....11-26
1-12 Bridge, Rensselaer, Ind.....10-29

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12- 3 Foundations, New York.....11-19
12- 7 Nurses' home, New York.....11-26
12- 7 Jail, Lebanon, Ind.....11-12
12- 7 Library, Covington, Ky.....11-26
12- 7 Schools, New York.....11-26
12- 7 Infirmary, Oak Park, Ill.....11-26
12- 7 Hotel, Chicago, Ill.....12- 3
12- 8 School, Indianapolis, Ind.....12- 3
12- 8 Buildings, Industry, N. Y.....12- 3
12- 8 Stable, Ft. Benj. Harrison, Ind.11-26
12- 8 Post-office, Gainesville, Ga.....11-12
12- 8 Fire houses, New York.....11-26
12- 9 Buildings, Columbus, Ohio.....11-19
12- 9 Flour and sawmill, Jocko, Mont. (Mfg. Pl.).....11-19
12-10 Plans, Johnstown, N. Y.....12- 3
12-10 Fire house, New York, N. Y.....12- 3
12-14 Schools, New York.....12- 3
12-14 Quarters, Ft. Geble, R. I.....12- 3
12-14*Buildings, Ft. Meade, S. Dak...11-12
12-15 School, Cincinnati, Ohio.....11-26
12-18 Steel, Madison, Wis.....11-19
12-19 School, Passaic, N. J.....11-23
12-19 Court-house, St. Anthony, Idaho.11-26
12-20 Plans, East Liverpool, Ohio.....11-26
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12-21 Ice machine, etc., Burrwood, La. (Mfg. Pl.) 12- 3
12-21*Hydrotherapeutic equipment, Hot Springs, S. Dak.....11-26
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12-22 Post-office, Coldwater, Mich.....11-19
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12-28*Post-office, Alexandria, Minn...11-19
12-28*Post-office, Americus, Ga.....11-19
12-28 Post-office, Lake Charles, La....11-19
12-29 Post-office, Alton, Ill.....11-26
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1- 2 Church, Elkhart, Ind.....12- 3
1- 4 Post-office, Sault Ste Marie, Mich.11-26
1- 5*Post-office, Niles, Mich.....11-26
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12- 7 Pumping station, Murdo, S. Dak.11-26
12- 7 Water system, Fort Getty, R. I...12- 3
12- 8 Force main, Spokane, Wash.....12- 3
12- 8*Cast-iron pipe, Amsterdam, N. Y.11-26
12- 8 Reservoir, engine, Meridian, Miss.11-19
12- 9 Water mains, New York.....11-26
12-10 Water mains, Covington, Ky.....12- 3
12-14*Steel tank and tower, Gridley, Cal.....11-19
12-15*Well, Herrin, Ill.....11-26
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12-16 Corporation cocks, New York....12- 3
12-21 Water pipe, Astoria, Ore.....12- 3
1-12 Water-works, Connersville, Ind..12- 3
1-15*Cement, Portland, Ore.....11-26
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12- 7 Storm drain, Los Angeles, Cal...12- 3
12- 7 Sewer, Muskegon, Mich.....11-19
12- 8 Sewers, Philadelphia, Pa.....12- 3
12- 8 Sewer bonds, El Centro, Cal.....11-19
12- 8 Sewers, New Brighton, N. Y....11-26
12- 8 Sewer extension, Hobart, Okla...11-26
12- 9 Sewers, Hamilton, Ohio.....12- 3
12-10 Sewage disposal plant, Danville, Pa.....12- 3
12-11 Sewer, Louisville, Ky.....12- 3
12-14 Sewer, Redfield, S. Dak.....12- 3
12-15*Sewer system, Fitzgerald, Ga....12- 3
12-15 Sewer, Independence, Kan.....12- 3
12-15 Sewer, Toronto, Ont.....11-26
12-16 Sewers, Brooklyn, N. Y.....12- 3
12-18 Sewers, Louisville, Ky.....12- 3
12-21 Drain pipe, National Soldiers' Home, Va.....12- 3
12-22 Sewerage system, etc., Mount Vernon, Ohio.....12- 3
12-28 Sewer, Pipestone, Minn.....12- 3

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12- 3 Road construction, New York....11-26
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12-10 Roads, Frankfort, Ind.....11-26
12-11 Road impvt., Cincinnati, Ohio...11-26
12-12 Paving, Purcell, Okla.....12- 3
12-14 Roads, Fort Riley, Kan.....11-26
12-17*Grading, etc., Newton, N. J.....11-19
12-28 Roads, Anderson, Ind.....11-26

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12- 3 Railing, New York 11-26
12- 3 Settees, New York 11-26
12- 3 Repairing ferryboats, New York.11-26
12- 3 Pipe fences, New York 11-26
12- 3 Lumber and piles, Panama.....12- 3
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12- 4*Tile, Cerro Gordo, Ill.....11-26
12- 4 Drain, De Kalb, Ill. 11-26
12- 4 Dredging, Boston, Mass.....11-26
12- 4*Gymnastic apparatus, Prescott, Ariz.....11- 5
12- 4*Tunnel, shaft, elevator, Niagara Falls, N. Y.....11-19
12- 5 Wharf, dredging, Norfolk, Va. ..11-26
12- 5 Ditch, Sadorus, Ill.....12- 3
12- 5 Dam, Dayton, Ohio 12- 3
12- 7 Dam, Clinton, N. C.....12- 3
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12- 7 Ballast, Ft. Leavenworth, Kan..12- 3
12- 8 Lumber, Toronto, Ont.....12- 3
12- 8 Supplis, New York 12- 3
12- 9 Towing machines, Panama 12- 3
12- 9*Dredging, Savannah, Ga. 11-12
12- 9*Dredging, Boston, Mass.....11-12
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12-11 Levee, Lewisville, Ark.....12- 3
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12-12 Dredging, Oakland, Cal. 11-26
12-12 Paving, Purcell, Okla.....12- 3
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12-15 Paving, Houston, Tex.....12- 3
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12-19 Grand stand, Carthage, Ohio....12- 3
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12-23 Road impvt., Cleveland, Ohio....12- 3
12-24*Seawall, Fort Morgan, Ala.....12- 3
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12- 9 Computers, Wash., D. C. 11-19
12- 9 Assistant, Wash., D. C. 11-19
12- 9 Asst. Inspector, Wash., D. C. ...11-19
12-12 Junior Draftsman, Albany, N. Y..12- 3
12-15 Instructors, Albany, N. Y.....12- 3
12-15 Laboratory Asst., Wash., D. C...11-19
1- 6 Hull Draftsman, Wash., D. C...12- 3

RAILWAYS.

BAYFIELD TRANSFER.—This company, which operates a line from Bayfield, Wis., to West End, 14 miles, and from Bayfield to Redcliff, four miles, may build an extension line from Bayfield west to Superior, 70 miles. H. C. Hale, Gen. Mgr., Bayfield.

COAL & COKE RY.—A branch will be built from Gassaway, W. Va., to Sutton, six miles. A. M. Smith is Gen. Mgr., Elkins, W. Va.

BEAVER VALLEY & NORTHWESTERN.—J. M. Kerns, Sunset, Okla., Gen. Mgr., advises us that this company has let contract for building this railroad in Oklahoma from Gage, via Beaver, to Hooker, a distance of 104 miles, to T. E. LUTTGERDING, Turner Bldg., Wichita, Kan. Surveys are made. Capital for construction and right-of-way have been obtained. H. A. Perkins is Ch. Engr., Beaver, Okla. Previously noted.

CANADIAN, LIVERPOOL & WESTERN.—This company is being organized, it is announced, and will shortly apply for a charter to build a line from the Grand Trunk Pacific Ry., near the St. Maurice River, in a northeasterly direction to the south shore of Lake St. John, thence east along the Saguenay River, with a branch line from the mouth of the Saguenay River, in a southwesterly direction along the St. Lawrence River to Quebec, thence along the western shore of the St. Lawrence River to Montreal. Smith & Johnston, Ottawa, Ont., are solicitors for this company.

COLORADO, HEREFORD & GULF.—This railway is now under construction from Hereford, Tex., southwest to Adrian, 36 miles. The SOUTHWESTERN ENGINEERING & CONSTRUCTION CO., Hereford, is the contractor, as fully noted on June 11. This line is projected from Dalhart, Tex., southwest to San Angelo, 420 miles.

COLUMBUS & SOUTHERN.—This company now operates a line from Wyandot Junction, Ohio, southeast to South Bloomingville, 34 miles. A survey from South Bloomingville to Hamden Junction, 34 miles, is under way. I. F. Anderson, Laurelville, Ohio, is Gen. Supt.

DAKOTA & WESTERN.—A. M. Lanphere, Pres., Rapid City, S. Dak., informs us that this railway will be 35 miles long and will connect Rapid City and Hill City, S. Dak. The line is half completed now. Company will not build any more of its railway this winter. Noted on Oct. 22.

DELAWARE TUNNEL R. R.—A charter has been granted to this company in Pennsylvania. Capital, $10,000. Company proposes to build a tunnel under the Delaware River from Second and Market Sts., Philadelphia, Pa., to the New Jersey line, where connection will be made with the tunnel to be built by a New Jersey corporation from the Camden, N. J., side of the river. The incorporators include W. A. Stern, President; I. H. Silverman, A. W. From and L. A. Isenthal, all of Philadelphia.

ERIE.—George F. Brownell, Vice-Pres., and H. P. Blauvelt, Comptroller of the Erie Railroad Co., have made application to the Public Service Commission of the Second District with headquarters in Albany for permission to issue new bonds to the value of $30,000,000, for the purpose of refunding obligations and making improvements during the next two years. The company, in its application, summarizes the cost of the improvements contemplated as follows: Immediate, $6,902,269; within the next two years, $11,180,500; equipment, $8,667,347; total, $26,750,476. The company's representatives say it was planned to expend $5,500,000 for reduction of grades between Newburgh Junction, N. Y., and Jersey City, and $1,500,000 from Cuba to Salamanca, N. Y. When this is accomplished, with the two cutoffs (the Erie & Jersey Railroad and the Genesee River Railroad) in full operation, the company will be enabled to run solid trains without reduction of tonnage from Salamanca to Jersey City. Large improvements will be provided for, including terminals, car and engine shops, elimination of grade crossings, additional tracks and sidings and station and other facilities along its entire route. Good progress has been made on the construction of the Genesee River Railroad, building a low grade line from Cuba, N. Y., north to Hunts, 33 miles. It is expected that work will be started improving the existing line between Salamanca and Cuba and between Hunts and Hornell, to be used in conjunction with the Genesee River Railroad, when work on that line is finished. Satisfactory progress, it is announced, has been made this year on the Columbus & Erie R. R., which was organized to carry out the part of the work in Pennsylvania, between Columbus, Pa., and Niobe, N. Y., 13 miles, on general grade improvements to be made between Port Jervis, N. Y., and Chicago. The plans call for the construction of a single-track line from Columbus to Niobe, and a low-grade double-track line from Niobe to Lakewood, N. Y., a total of 22.8 miles.

INDIANAPOLIS UNION RY.—The Board of Public Works, Indianapolis, Ind., has approved the track elevation proposition submitted by the Indianapolis Union Railway Co. It had already been approved by Blaine H. Miller, City Engr. The proposition submitted provides for the elevation of the tracks of the railroad company from New York St. to Prospect St., just west of Gale St. A track elevation resolution was adopted by the board some months ago and this was submitted to the railroad company. The latter has proposed that the work be done in four sections, to be completed at intervals of one year, the first to be completed Dec. 31, 1909. The railroad company proposes to elevate the tracks at East Washington St. first, and to do the city's share of the work, charging the city the exact cost of the material and labor. The railroad company will pay 75% of the expense, the remaining 25% to be paid by the city. Estimated cost, $800,000. A. A. Zion is Supt. of the I. U. Ry. Co., Indianapolis.

LITTLE RIVER.—The extension from Townsend, Tenn., to Elk Mountain, 18 miles, will be completed probably by Jan. 1. Jos. P. Murphy is Supt., and W. B. Townsend, Gen. Mgr., Townsend. The line now connects Townsend, Tuckaleechee, Riverside, Walkers and Walland, eight miles.

MEXICO.—Jose Y. Limantour, Minister of Finance of the Mexican Government, in his statement to Congress of the general plans and attitude of the government for enlarging the existing merger system and at the same time encouraging the building of independent lines of railways, says: "In regard to the railways in which the government is not interested and other transportation companies that may in future be organized, the federal government will not begrudge them its encouragment nor the franchises and right which the laws sanction. The government's policy with respect to the acquisition and consolidation of railways in no wise alters its determination of long years standing to encourage the construction of new lines and the expansion of existing ones. The government's policy does not aim at absorbing all the railways. Subject to the programme which has been developing, the government is preparing to encourage the establishment of routes of communication in all portions of the national territory in so far as its available resources permit. As regards the extension and betterment of the lines constituting the National Railways, it considers that it has done all that is possible, when organizing the company and devising the financial plan to provide it with the necessary resources as occasion may demand. The government also purpose to conduct thorough studies as to the natural wealth of various regions not as yet served by a railway and as to the physical or financial difficulties that would beset the construction or operation of such roads. The order to be followed in their construction will naturally depend on the prospects of traffic for each, as well perhaps as on the pecuniary cooperation offered by the authorities of the different districts and by the cities and residents chiefly concerned."

OREGON SHORT LINE.—Survey is being made for the proposed branch from Montpelier to Garden City, Idaho. Wm. Ashton is Ch. Engr., Salt Lake City, Utah.

PEORIA & GALESBURG.—Incorporated in Illinois with capital stock of $100,000. The road is to be constructed from Peoria through Peoria and Knox Counties to Galesburg, and from Peoria through Peoria and Fulton Counties to Canton, Fulton County. Incorporators and first Board of Directors: D. M. Mayer, Arthur C. Black and S. F. Atwood, Peoria. William K. Boone, Lima, Ohio.; Homer T. Dick, Chicago.

ST. LOUIS, BROWNSVILLE & MEXICO.—Steps have been taken toward extending this railroad from Brownsville, Tex., to Tampico, Mexico, a distance of about 300 miles. J. N. Miller is Gen. Mgr., Kingsville, Tex.

SIERRA MADRE & PACIFIC.—H. R. Nickerson, Pres. and Gen. Mgr., 27 Pine St., New York City, has announced, according to press reports, that he had secured concessions and will immediately extend the road from its present terminus, south of El Paso, to the Yaqui River in Sonora, connecting there with Harriman's new Yaqui River line, from Guaymas. The company now operates this railroad from Temosachic to Madera, State of Chihuahua, Mexico, 32 miles.

TEXAS SHORT LINE.—This company, which has 17 miles graded on its proposed line, desires to close a deal with a contractor to grade eight miles more and lay track, besides completing bridges and other structures. Address John D. Harkman, Attorney, 2124 West Commerce St., care Substation A, San Antonio, Tex. Company proposes to build from Comfort to Fredericksburg, Tex., 25 miles, as noted fully on May 7.

VIRGINIAN RY.—Contracts for the construction work on the Winding Gulf branch, between Mullens, W. Va., and Pemberton, about 25 miles, have been awarded to the following contractors: T. TOWLES & CO., Mullens, W. Va., 2-mile section; W. O. LIPSCOMB, Roanoke, Va., three miles; J. C. CARPENTER & CO., Clifton Forge, Va., 15 miles; MASON & HANGER CO., Richmond, Ky., five miles.

ELECTRIC RAILWAYS.

ROCKLAND, ME.—The Rockland, South Thomaston & Owls Head Railway, four miles long, which has been in the hands of receivers, who have operated it for the past three years, was sold at auction by them last week for $25,000 to John L. Donahue, of Rockland. It is stated that improvements will be made and the company reorganized.

NORWICH, CONN.—The stockholders of the Norwich, Colchester & Hartford Traction Co. have perfected organization, and they will complete arrangements for a survey of a trolley line from this city to Hartford. The Directors have organized with the election of Costello Lippitt as Pres., Lucius Brown Secy. and Henry W. Tibbits Treas., all of this city.

NEW YORK, N. Y.—The Harlem & Port Chester R. R. Co., a subsidiary line of the New York, New Haven & Hartford Railroad Co., has applied to the Public Service Commission for permission to change the motive power on its line from steam to an electric current system similar to that used by the New Haven road between this city and Stamford. The Harlem River & Port Chester line runs from 129th St. and the Harlem River to New Rochelle, where it joins the main line of the New Haven. The petition sets forth that the N. Y., N. H. & H. Co. plans to finance the new construction from the proceeds of an issue of $15,000,000 of bonds, known as the New York, New Haven and Hartford Railroad Co.-Harlem River & Port Chester first mortgage 4% 50-year gold bonds, secured by a first mortgage, dated May 16, 1904, made to the United States Trust Co., of New York, as trustee, which issue was consented to by the Board of Railroad Commissioners on Sept. 6, 1904. Edw. Gagel is Ch. Engr. of the N. Y., N. H. & H. R. R. Co., New Haven, Conn.

PHILADELPHIA, PA.—The Delaware Tunnel R. R. Co. has been granted a charter in Pennsylvania to build two tunnels running under the Delaware River, from Second and Market Sts., Philadelphia, to Third St., Camden. The tunnel cars will run to the eastern limit of Camden by a new elevated which will be built at the same time. The fare from any point in Camden across the river will be five cents. Capital stock, $10,000. Incorporators: William A. Stern, Isaac Silverman, Benjamin Wolf, Edwin Wolf, Mr. Wagner, and A. W. Freeman, all of Philadelphia.

MARTINSBURG, W. VA.—The Common Council of Martinsburg has granted to the Berkeley Traction Co. a franchise for an electric trolley line over the streets of the city, and work will be commenced not later than April 1, 1909. A. G. Fickeisen and Louis P. Frobe, of Wheeling, W. Va., are interested. Capital stock is $500,000. Noted on Oct. 15.

WINSTON-SALEM, N. C.—Dr. H. P. MacKnight, proprietor of Vade Mecum Springs, who is building a standard-gage electric railway from Winston-Salem to Stuart, Va., via Rural Hall, Capella Gap, Vade Mecum, Moore's Springs, Piedmont, Danbury and Sandy Ridge, N. C., 69.7 miles, writes us that bids will be received about Feb. 1 for the installation of two electric generating plants on the Dan River to furnish power for this railway and also for manufacturing plants, lighting of towns and for general purposes. Grading and track laying will be superintended by Dr. MacKnight, Ch. Engr., Southern Pines, N. C. The company will be known as the Crescent Electric Ry Co., E. Hillman is Pres., Aberdeen, N. C. Surveys are made and right-of-way secured. Capital is partly obtained. Noted on Oct. 29.

BURLINGTON, N. C.—The Burgrahaw Interurban Co., recently incorporated with $500,000 capital, will take over the rights, franchises, etc., of the Burgrahaw Traction Co., it is announced, and will build and equip an electric interurban railway about eight miles long, connecting the towns of Burlington, Graham and Haw River. Engineers are in the field. Construction will begin about Jan. 1. J. W. Murray will be Pres. and J. H. Harden Secy.

CLARKSVILLE, GA.—The Clarksville Railway Co. has been chartered to build a street railway. Capital, $10,000. E. S. Hunnicutt, Robert McMillan and others are the organizers. Noted on Oct. 15.

DAYTONA, FLA.—The American Trackless Trolley Co. plans to begin construction work in about 30 days on the electric trackless trolley system, which is to connect Seabreeze and Daytona Beach. A franchise has already been secured from Seabreeze, and the franchise from Daytona is now pending in the City Council. Capital stock, $200,000. S. H. Gove is Gen. Mgr., Daytona.

YAZOO CITY, MISS.—The Municipal Street Ry. Co. expects to have its line completed this month. Track is laid on the two main lines. W. F. Cummins, Jr., City Clk., will receive bids until 8 p. m., Dec. 14, for a 10-year lease of this railway.

INDIANAPOLIS, IND.—We are officially informed that the Indianapolis, Cloverdale & Vincennes Traction Co. will be incorporated soon, and will take over the property, right-of-way, franchises, etc., of the Indianapolis, Cloverdale & Terre Haute Ry. The new line will connect Mooresville, Cloverdale, Bowling Green, Clay City, Jasonville, Linton and way points to Vincennes. Total length of the line will be about 125 miles. Right-of-way is already secured over a large part of the line. Survey of the first 45 miles of the route has been started. Capital is being arranged for, and this part of the line will be pushed to rapid completion. Harry C. Sandusky, 413 State Life Bldg., Indianapolis, is Ch. Engr. Noted on Sept. 17. Edward M. Bowman is Pres., 1110 Odd Fellows Bldg., Indianapolis.

EVANSVILLE, IND.—Regarding the report that "the Evansville & Southern Indiana Traction Co. is surveying the proposed extension from Patoka to Hazleton, Ind.," F. N. Durbin, Gen. Mgr., Evansville, advises us that there are no definite plans for this work.

DECATUR, IND.—The Fort Wayne & Springfield Ry. Co., which now operates a line connecting Fort Wayne, Decatur, Monmouth and Middletown, 21½ miles, plans to build an extension about twelve miles long. A. W. Fishbaugh, Ch. Engr., Decatur.

CASEYVILLE, IND.—The East St. Louis, Caseyville & Eastern Ry. Co. has been incorporated in Illinois to construct an electric railway from East Lamdgwne to Caseyville. Incorporators: F. G. Harding, Joseph Harding and E. G. Helm, East St. Louis, Ill.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Co. plans to begin next spring the construction of its extension from St. Martins to Burlington, a distance of about 20 miles. The cars of this line will use the existing track of the East Troy line to St. Martins, from which point it will run southwest through Waterford and Rochester to Burlington. John I. Beggs is Pres. and Gen. Mgr., Milwaukee.

PARSONS, KAN.—Cyrus E. Meade, of Toledo, Ohio, has been granted a franchise here for an electric railway.

HEBER, ARK.—The Heber Light & Traction Co., which holds the franchise for a street railway in Heber, is now surveying its line, which will be about 1½ miles in length. It is proposed to operate gasoline motor cars, but later on the road will be electrified. Capital stock, $50,000. Officers: Dr. C. F. Crosby, Pres.; R. T. Martin, Vice-Pres.; W. L. Thompson, Secy.; H. F. Fix, Treas.; W. H. Horton, Gen. Mgr., all of Heber. Noted on Oct. 29.

EL PASO, TEX.—The City Council has decided to submit to a vote of the people the applications of Frank R. Tobin for an electric railway franchise in El Paso, and thence to Fort Bliss and the town of Tobin. Noted fully on Nov. 5.

WAXAHACHIE, TEX.—A franchise has been granted Howard M. Hyatt, Secy. of the Empire Construction Co., Kansas City, and A. C. Harrington, of Indianapolis, civil engineer for the company, for the construction and operation of an interurban railway through Waxahachie. The franchise covers a period of 25 years. The line is to be built from Dallas via Waxahachie and Cleburne to Fort Worth. A franchise through Cleburne was secured some time ago.

SEATTLE, WASH.—The Seattle & Issaquah Electric Ry. Co. has been chartered in Washington to build and operate electric railways between points in King and Snohomish Counties. Capital stock, $2,000,000. Incorporators: Edwin S. Gill and John McQuade.

MARSHFIELD, ORE.—Henry Hewitt, Jr., Tacoma, Wash., is interested in project to build an electric railway which will connect Marshfield and North Bend.

FRESNO, CAL.—The Fresno Traction Co. has awarded the contract to G. A. WILSON, of Fresno, for building the extension of the Forthcamp line seven-eighths of a mile beyond Belmont Ave. The work of construction will be started at once.

PHOENIX, ARIZ.—Capital is said to have been secured by Harry J. Bennett, of Phoenix, who will build an interurban electric line to connect Phoenix, Tempe and Mesa.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

NEW YORK, N. Y.—Bids are asked until 3 p. m., Dec. 10, by the Park Board, Henry Smith, Pres., for furnishing and delivering seven electric motors at the American Museum of Natural History, Boro. of Manhattan.

Plans have been filed by Church E. Gates & Co. for the construction of a power-house on their property at 138th St. and Fourth Ave., to cost approximately $50,000.

ROCHESTER, N. Y.—The Rochester Railway & Light Co. will build a vertical retort gas plant on Vincent Flats. The building will be 80 × 100 ft., 60 ft. high, of brick, concrete and steel construction, with a capacity for 100 vertical retorts of the Dessau system. The plant will cost about $150,000. Plans are being prepared and bids will be received after Jan. 1. R. M. Searle is Gen. Mgr.

SYRACUSE, N. Y.—The contract for installing the heating and power plant in the Onondaga County Hospital buildings has been awarded to THOMAS E. GILDEA, of Syracuse, N. Y., for $23,743.

PLATTSBURG, N. Y.—We are officially advised that bids were received on Nov. 18 by the Constructing Quartermaster, Plattsburg Barracks, for constructing a transformer station and installing an electric lighting system at this post; also for furnishing electrical energy for operating the system. The bids were as follows: (a) wiring and fixtures, (b) pole-line, (c) fixtures for sub-station, (d) wattmeters, (e) substation: General Electric Co., Schenectady, N. Y., (c) $1,846, (d) $2,053; McCay Engineering Co., Baltimore, Md., (b) $7,275, (d) $2,454; Alfred Farley, Plattsburg, N. Y., (a) $25,842, (c) $2,396; M. B. Foster Electric Co., New York, (a) $27,460, (b) $6,200, (c) $2,188, (d) $2,812, (e) $4,226; J. A. Freeman, Plattsburg, N. Y., (a) $24,185, (b) $6,000, (c) $1,500, (d) $3,100, (e) $2,688; E. J. Duggan, New York, (a) $25,350, (b) $5,188, (c) $2,088, (d) $2,567, (e $4,316; Whitall Electric Co., Westerly, R. I., (a) $33,700, (b) $7,242, (c) $1,974, (d) $2,768, (e) $3,232; LeBaron B. Johnson, New York, (a) $29,196, (b) $8,962; W. M. Sheehan & Co., New York, (d) $2,170. Plattsburg Light, Heat & Power Co., Plattsburg, N. Y., current for Tungsten street lamps, per lamp per year, $18.24; current for interior lighting, separate meters, per KW.-hour, 5½ cts.; all current measured on primary at sub-station, per KW.-hour, 5 cts. Lieut. J. W. Boyd is Constr. Q. M.

WADDINGTON, N. Y.—The New York & Ontario Power Co., which owns the water-power rights at this point has petitioned the Public Service Commission for authority to issue $1,850,000 in first mortgage bonds and $604,741 in capital stock for the purpose of constructing and operating a power plant.

*RUTHERFORD, N. J.—Bids are asked by the Borough of Rutherford until 8 p. m., Dec. 11, for lighting the streets, avenues and public places of this borough with gas and incandescent and arc electric lamps. Frank A. Stedman is Boro. Clerk.

*WARREN, PA.—Bids are asked until 1 p. m., Dec. 18, by the Building Committee of the Board of Trustees of the State Hospital for the Insane, Warren, Pa., S. W. Waters, Secy., for the furnishing and installing of two natural gas engines, generators and switchboards for electric lighting and power plant. J. W. Greeland is Steward.

SPRINGBORO, PA.—Application has been made to the Council by Edward B. Fish and E. H. Fisher, both of Conneautville, Pa., for a franchise to furnish electricity for street and commercial lighting.

MANORVILLE, PA.—The Manor Light, Heat & Power Co., of this city, has been formed and incorporated under the laws of this state, with an authorized capital stock of $10,000, to furnish electric light, heat and power to the Borough of Manorville, Armstrong County, Pa.

FORD CITY, PA.—The Ford City Power Co., of this city, has been formed and will be incorporated under the laws of this state to furnish electric light, heat and power to public and private interests here.

JOHNSTOWN, PA.—The City Councils, at a joint meeting, awarded the contract for lighting the city with electric light for a period of ten years, from Jan. 1, 1909, to the CITIZENS' LIGHT, HEAT POWER CO., of this city. The contract calls for furnishing power and arc lamps for the above period at $50 per year, and power and 70-c. p. incandescent lamps at $25 each per year.

SANFORD, N. C.—Specifications are being prepared for a sub-station to be erected by the Carolina Light & Power Co. (successor to the Central Carolina Power Company) in Sanford, for the transmission of electrical energy from the hydro-electric plant at Buckhorn Falls, on Cape Fear River, to Sanford. Electricity will be supplied for street lighting in Sanford and to manufacturing plants.

CHARLOTTE, N. C.—B. H. HARDAWAY, of Columbus, Ga., has been awarded the contract by the Southern Power Co., of Charlotte, to build a dam across Broad River at Ninety-nine Islands, S. C., for a 16,000-HP. electrical plant. The contract price was $650,000.

WHITE SPRINGS, FLA.—Plans and specifications are being prepared by D. G. Zeigler & Co., of Atlanta, Ga., for the construction of a large power plant on the Suwanee River, near White Oaks, by the Suwanee River Railroad & Power Co. Contracts for the construction will be awarded about Dec. 15. It is proposed to develop about 25,000 HP. at a cost of about $3,000,000.

EAST LIVERPOOL, OHIO.—The City Council has awarded the contract for electric street lights for a period of five years from Jan. 1, 1909, to the EAST LIVERPOOL TRACTION & LIGHT CO., of this city, at $34 per 80-c.p. light per year and $66 per year for regulation arc lights.

DAYTON, OHIO.—Bids will be received by the Board of Education of the city of Dayton, Ohio, until Dec. 10, for furnishing one 125-HP. reciprocating engine and one 75-HP. turbine engine, direct connected to generator of same rating as engine, with switchboard, etc., complete, installed ready for use. O. J. Needham is Pres. of Bd.

CUYAHOGA FALLS, OHIO.—We are officially advised that Mr. H. von Schon, Consulting Engr., Wayne County Bank Bldg., Detroit, Mich., has been engaged to prepare plans for hydro-electric development of the power of Cuyahoga Falls, Ohio.

LA FAYETTE, IND.—The Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind., expects to remodel its power station at La Fayette, Ind. C. D. Emmons is Gen. Mgr.

MULBERRY, IND.—The Town Board has decided to construct and equip an electric light plant. Bids will be in order as soon as plans are completed.

LINTON, IND.—The City Council is stated to be in the market for $15,000 worth of equipment for the municipal electric light plant.

SCOTTSBURG, IND.—The City Council will build and equip an electric light and water-works plant. Plans have been ordered.

HAGERSTOWN, IND.—The Trustees of the municipal electric light plant contemplate constructing a new power-house to operate the plant.

DANVILLE, IND.—The Danville Heat, Light & Power Co. has increased its capital for the purpose of enlarging plant and installing additional equipment.

TIPTON, IND.—The Indiana Gas & Electric Light Co. contemplates erecting and equipping a central gas plant in this city.

LINTON, IND.—The City Council has taken steps toward the enlargement and re-equipment of the municipal electric light plant.

CHEBOYGAN, MICH.—The Eastern Michigan Power Co., which will develop the power of the Au Sable River, has secured 90% of the land needed for flowage rights, it is stated. It is proposed to build ten or twelve dams within a distance of 100 miles on the river. Electricity for lamps and motors will be offered to cities within a radius of 200 miles.

GRAND RAPIDS, MICH.—The Menominee & Marinette Light & Traction Co. has awarded contracts for equipment of its power plant at Grand Rapids as follows: For water turbines, with a total rating of 4,250 HP., and four Lombard automatic governors, to the GLOBE IRON WORKS, of Dayton, Ohio; generators, transformers, switchboards, etc., to the WESTINGHOUSE ELECTRIC & MFG. CO., of Pittsburg, Pa. Edward Daniell, Menominee, is Gen. Mgr.

MADISON, WIS.—The C... Commission has awarded the contract ... electrical fixtures, wiring, conduiting ... telephone system and power system for ... west wing of the Capitol to PAUL F. HA... PF, of Madison, Wis., for $14,560.

DAVENPORT, IOWA.—P... being prepared by the People's Li... for extensive additions and improve... to its plant in Davenport next year, w... will involve an expenditure of about $2... company contemplates making ... The company its systems in Rock Island ... improvements to which plans and estimates ... Moline, for now being prepared.

JEFFERSON BARRACKS, ... Bids are asked until 11 a. m., Dec. ... Capt. O. W. Bell, Q. M., for a ... electric lighting system, consisting ... following items: Wiring buildings, ... following lines, furnishing electric fixt... connecting poles ers and apparatus. Also to ... transformers current for lighting will be ... with electric

ELSBERRY, MO.—We are ... officially advised that bids were receive... Nov. 12 for furnishing material and ... construction of a municipal electric light ... including horizontal tubular boilers, ... speed direct-connected engine, heater ... feed pumps, steam piping, alter... ing-current generator, direct connected, ... board, incandescent street lighting apparatus, pole line, transformers, etc., and the construction of a brick power-house. A. Fuller, Chemical Bldg., St. Louis, Mo., is Engr. The following contracts have been let: Steam plant, BROWNELL CO., Dayton, Ohio; electric apparatus, ALLIS-CHALMERS, Milwaukee, Wis.; power-house, W. M. PALMER, Elsberry. Cost, $10...

RUSSELLVILLE, ARK.—It is reported that the Russellville Water & Light Co., recently incorporated to take over the water and light plant at Russellville, will commence work on the construction of an electric light plant and water-works system, the cost of which is estimated at $... The pumps and other machinery will be operated by water power. The plant will furnish electricity for lamps and motors for cities and towns within a radius of 20 miles of Russellville. The offices of the company will be located in Pine Bluff, Ark. A. Brewster is Pres.

GREELEY, COLO.—We are officially advised that the Home Electric Light & Power Co., of Greeley, now operating a gas producer and gas engine station, is having plans made for the enlargement of its station and for extending its distribution system. Robert McF. Dobie, Majestic Bldg., Denver, Colo., is Consult. Engr.

SPOKANE, WASH.—According to press reports, more than $16,000,000 is to be raised by the Washington Water Power Co. for extensions and additions planned for the next few years, to be expended at the rate of $2,000,000 each year. The capital stock of the company previously authorized is to be increased $1,033,260, 20% of the present issue of $5,016,300. The company conducts two important lines of business—the electric street railway lines throughout Spokane and vicinity, and interurban railway lines to Medical Lake and Cheney, and the distribution of electric energy for lighting and power. To furnish electrical energy the company has three stations now in Spokane and Post Falls and a steam plant located in Ross Park. Another important power station is under construction at Little Falls, 13 miles north of Reardan on the Spokane River. Henry M. Richards is Pres.; D. L. Huntington is Mgr.

EUGENE, ORE.—Arrangements are being made to construct a municipal power plant in Eugene, at a cost of about $130,000. Bids for the construction will be received in about 30 days. Frank C. Kelsey, 415 Corbett Bldg., Portland, Ore., is Engr.-in-Charge.

PORTLAND, ORE.—B. S. Josslay, Pres. of the Portland Railway, Light & Power Co., has approved the order for commencing work on the underground conduit system in the business section of the city. The system will cost not less than $1,250,000. Machinery and apparatus at the present sub-station at Seventh and Alder Sts. will be replaced with new at cost of $150,000.

Development of a power plant on the Clackamas River is the plan of F. S. Morris, of firm of Morris Bros., bankers and brokers. The plant will cost about $500,000 and will generate about 15,000 HP. A dam 400 ft. long × 40 ft. high will be built. Work on clearing the ground and building bunk-houses for laborers has begun. It is expected that foundations for the dam will be started next summer.

RED BLUFF, CAL.—The Northern California Power Co., Union Sq. Bldg., San Francisco, which has three electric plants in operation in this part of the State, has commenced work on a fourth plant, which will be located on Battle Creek, in the Manton District, and which will generate 6,000 HP. of electricity when completed. Owing to the difficulty of hauling the steel pipe necessary for the plant, the company is erecting a machine and boiler shop at the site of the power plant and will manufacture the pipe there, hauling in the materials. The waters of several irrigating ditches will be added to the creek waters to furnish an adequate supply for the new power plant. E. V. D. Johnson, Redding, Cal., is Mgr.

KINGSBURG, CAL.—The Fresno Traction Co., which controls the Fresno-Hanford Interurban line, has decided to generate power for running cars and a plant to be started near Kingsburg. A. G. Wishon is Gen. Mgr., Fresno, Cal.

HADEN, IDAHO.—Julian M. De Coster, Haden, advises us that he and Fred T. Mitchell are interested in the development of power on the Teton River. The Teton River Power Co., which they control, has secured rights to a 156-ft. fall of water.

SYDNEY, N. S.—The Dominion Iron & Steel Co., Ltd., and the Nova Scotia Steel & Coal Co., Ltd., are contemplating the installation of steam turbine plants, it is stated. John Preston, Mechanical Engr. of the Nova Scotia Steel & Coal Co., has re-

ported in favor of the installation of a turbo-generator at Sydney Mines and it is expected that this will be put in at once. The other companies probably will add turbo-generators to their plants in the spring.

MONTREAL, QUE.—The Montreal Light, Heat & Power Co. intends to start on the construction of an additional steam plant, with a maximum equal to 100,000 HP. The addition will be completed unit by unit, but it is stated that the entire execution of the contract will have been carried out within two years. H. M. Wilson, Montreal, is Supt.

TORONTO, ONT.—A water power development is planned by the Electric & Water Power Co. J. J. Wright, of Toronto, Ont., is Mgr.

MERRITTON, ONT.—The contract for transformer for stepping down from 2,200 to 110 volts and for wire goose-neck lamps and all other fixtures for a complete incandescent street lighting system has been let to ROBERTSON ELECTRIC CO., 19 Terrace St., Buffalo, N. Y.

•WINNIPEG, MAN.—Bids are asked until 5 p. m., Dec. 28, by M. Peterson, Secy. Bd. of Control for the construction of the general works and for the supply and erection of various portions of a transmission line between Point du Bois and Winnipeg. Individual bids will be received for: General works at Point du Bois; erection of transmission line; steel towers; electric transmission cable. Smith, Kerry & Chace, Confederation Life Bldg., Toronto, Ont., are Engrs.

FERNIE, B. C.—Bids are asked by A. A. Sharley, Acting City Clerk, until noon, Dec. 15, for installation of a 260-HP. gas producer plant on conditions that a satisfactory arrangement can be made with the Crow's Nest Pass Electric Light & Power Co.

VICTORIA, B. C.—The city is seeking authority from the Provincial Government to generate and distribute electric power. W. W. Northcote is interested.

FRANKLIN, KY.—The Franklin Electric & Ice Co., Inc., with $40,000 capital stock to establish electric light and ice plants, will erect a building and install electric and ice machinery.

HEDLEY, B. C.—The Hedley Power & Development Co. has been organized here to supply electricity to the mines. Application has been made for 2,000 ins. of water from the Similkameen River and a power site has been selected. L. H. Patten, Hedley, B. C., is interested.

BRIDGES.

(• denotes that this work is advertised in Engineering News.)

•BRIDGEPORT, CONN.—Bids are asked until noon, Dec. 15, by H. E. French, Secy. Congress St. Bridge Comn., for the construction of a highway bridge at Congress St. and also for the removal of the substructure and superstructure of the present bridge.

NEW YORK, N. Y.—Plans have been filed with the Building Superintendent for the new two-story ornamental entrance and passage bridge to the Manhattan ferry terminal of the Central R. R. of New Jersey to be erected at 144 Liberty St., New York, with an "L" opening at 101 West St.

ALBANY, N. Y.—See under Miscellaneous Contracts—"Barge Canal, Albany, N. Y."

MONONGAHELA, PA.—The following bids were received on Nov. 25 by the Allegheny and Washington County Commissioners for the construction of a steel truss bridge across the Monongahela River here: Fort Pitt Bridge Works, House Bldg., Pittsburg, Pa., $226,267; Toledo-Massillon Bridge Co., Toledo, Ohio, $232,765; McClintock-Marshall Construction Co., Park Bldg., Pittsburg, $228,018; King Bridge Co., Cleveland, Ohio, $234,500; American Bridge Co., 30 Church St., New York, $230,135; Penn Bridge Co., Beaver Falls, Pa., $245,333; Pennsylvania Steel Co., Girard Trust Bldg., Philadelphia, Pa., $245,980. The bid of the Fort Pitt Bridge Works was the lowest submitted, and this concern will probably receive the contract. This same concern was the low bidder on the same structure several months ago. The contract was held up on account of various disputes.

PLATTSBURG, N. Y.—The Clinton County Commissioners are having plans prepared and will call for bids in about two weeks for the construction of a 2-span steel bridge, with concrete abutment.

MORRISVILLE, PA.—Bids are asked by the County Commissioners until Dec. 21 for the construction of a reinforced-concrete bridge over the canal at Bridge St.

MACKEY FERRY, N. C.—J. E. Greiner, Mt. Royal Station, Baltimore, Md., has been appointed Consulting Engineer for the design and construction of a bridge over Albemarle Sound for the Norfolk & Southern R. R. Co. The bridge will connect Skinners Point, Md., and Mackey Ferry and will be five miles long. Estimated cost, about $1,000,000.

•BEAUFORT, N. C.—Bids were opened as follows on Nov. 20 by Capt. Earl I. Brown, Corps Engrs., U. S. A., for constructing a steel draw-span highway bridge with pile and concrete foundations on Core Creek near here: Penn Bridge Co., Beaver Falls, Pa., $23,922; Owego Bridge Co., Owego, N. Y., $27,965; Nelson Merydith Co., Lewis Block, Pittsburg, Pa., $23,635; Roanoke Bridge Co., Roanoke, Va., $26,812; Carolina Engineering Co., $27,962; Sweirs & Sutton, $21,584; Crafts & Smith, $20,705; Merrill, Ruckgober-Fraser Co., $25,245; New Jersey Foundry & Machine Co., 90 West St., New York, $26,-789.

SPARTANBURG, S. C.—Bids are asked until Dec. 3 by the county for the construction of a steel or wooden bridge over South Tiger River. W. Frank West is County Supervr.

GREENVILLE, S. C.—The Street Committee of the City Council has approved plans for the construction of a concrete bridge over Reedy River by the city and the Greenville Traction Co. Estimated cost, $25,000.

JACKSONVILLE, FLA.—The Duval County Commissioners have awarded the contract to the CONVERSE BRIDGE CO., Chattanooga, Tenn., at $5,729, for constructing a steel bridge at Talleyrand Ave.

PENSACOLA, FLA.—The Board of County Commissioners on Nov. 22 awarded a contract for the construction of a bridge to span what is known as Bayou Chico to the C. H. TURNER CONSTRUCTION CO.

GREENWOOD, MISS.—Bids are asked by the Supervisors of Le Flore County until Dec. 7 for the construction of a pile bridge across an opening 150 ft. long to be made in the levee near Browning Crossing.

NEW ORLEANS, LA.—The Commissioners of the New Orleans City Park Improvement Association, Paul Capdeville, Pres., have authorized the executive committee to advertise for bids for the proposed bridge to be constructed across Bayou St. John from Esplanade Ave. to City Park entrance. The structure is to be of iron or steel and used exclusively for pedestrians and vehicles.

CONCORD, TENN.—The County Road Commissioners have awarded the contract to J. M. JONES for constructing a new bridge over Sinking Creek, west of Concord. Work will begin at once.

WEST POINT, KY.—The Hardin County Fiscal Court, Elizabethtown, Ky., on Nov. 20 appropriated $8,000 toward the construction of a bridge over the Salt River at West Point. Work on the improvement will begin in the spring. Estimated cost, $35,000. Cyrus Viers is County Judge.

CINCINNATI, OHIO.—Bids will be received until noon Dec. 18 by the County Commissioners, Fred Dreihs, Clk., for constructing a steel girder bridge over the north branch of Sycamore Creek, in Symmes Township.

CLEVELAND, OHIO.—The Board of Public Service on Nov. 20 awarded the contract to L. W. MACKENZIE, Park Bldg., Cleveland, for the construction of a culvert at East 90th St.

GREENFIELD, IND.—The Commissioners of Hancock County are asking for bids for the erection of a bridge across Laribee Creek on New Palestine and Eastern gravel road. C. H. Troy, County Audr.

PAOLI, IND.—Bids will be received until Dec. 8 by the County Commissioners, Paoli, for constructing a 24-ft. span steel leg bridge and a concrete retaining wall 18 ft. in length at the Grape Vine Hollow arch on French Lick and Newton Stewart road, in French Lick Township. Alvin B. Ham is County Audr.

HUME, ILL.—A. N. Johnson, State Engr., Springfield, Ill., is preparing plans for the construction of seven bridges in Hume Township.

URBANA, ILL.—The City Council has awarded the contract to the DECATUR BRIDGE CO., Decatur, Ill., for the construction of two bridges in North Market St. and Cunningham Ave., at $4,290. Bids were opened on Nov. 14.

ELGIN, ILL.—JOHN ELTELGEORGE, Aurora, Ill., has secured the contract for constructing three bridges here.

MILWAUKEE, WIS.—Bids are asked until 10.30 a. m., Dec. 4, by the Board of Public Works for constructing a bascule bridge across the Milwaukee River at the foot of East Water St. Charles J. Poetsch is City Engr.

SHEBOYGAN, WIS.—Plans are about completed for the new bascule bridge which is to be erected across the river at Pennsylvania Ave. Estimated cost, $90,000. There will be a 24-ft. roadway, with two 7-ft. walks.

HOPKINTON, IOWA.—The Boards of Supervisors of Delaware and Jones Counties have decided to construct a bridge over the Maquoketa River four miles southeast of here. The bridge is to be a 100-ft. steel span with steel joists and lattice rail. The foundations are to be tubular iron piers, 24 ft. high and 42 ins. in diameter. A 20-ft. approach on steel piling with concrete backing will reach the main span at either end. The structure is to have a capacity of 1,600 lbs. per ft., moving load, and will be floored with 2½-in. oak or 3-in. planking.

CHARLES CITY, IOWA.—The Western Concrete Bridge Co., 119 Monroe St., Chicago, Ill., has submitted the lowest bid to the Floyd County Commissioners, at $34,400, for constructing the cement bridge across the Cedar River, on Main St. The letting of contract has been postponed until January. H. B. Rosenkrans is County Audr.

ST. PAUL, MINN.—The contract for the steel work on the new steel span bridge across the Mississippi River here for the Stockyards Terminal Ry. Co., William Magivny, Pres., has been awarded to the AMERICAN BRIDGE CO., Minneapolis, Minn. Estimated cost, $400,000.

CROOKSTON, MINN.—Bids are asked until 10 a. m., Dec. 7, by A. H. Childs, City Clk., for the construction of a steel bridge across the Red Lake River here.

PRESCOTT, ARK.—The Memphis, Paris & Gulf R. R. Co., C. C. Henderson, Nashville, Ark., Gen. Mgr., has awarded the contract to the KANSAS CITY BRIDGE CO., Kansas City, Mo., for the construction of a bridge across Little Missouri River.

FORT SMITH, ARK.—Sebastian and Crawford Counties are considering the construction of a free bridge across Arkansas River, to connect with Van Buren, Ark. W. A. Falconer, of Fort Smith, is Chn. Com.

MALVERN, ARK.—It is proposed to construct a bridge over Ouachita River at Green Ferry. Estimated cost, about $15,000. A. I. Roland is County Judge.

WASHINGTON, ARK.—Hempstead County will construct five steel bridges during 1909.

KINGFISHER, OKLA.—Bids will be received until Dec. 7 by George H. Woodworth, County Clk., for constructing a steel bridge over the Cimarron River.

PAWHUSKA, OKLA.—Bids will be received by the Commissioners of Osage County until 5 p. m., Dec. 8, for the construction of seven steel, one concrete and one stone arch bridges. H. J. Behning is County Surv.

NEW HOPE, CAL.—The Board of Supervisors of San Joaquin County, Stockton, will soon let the contract for the construction of a bridge over the Mokelumne River, between Galt and New Hope, to be known as the Galt-New Hope bridge.

SAN DIEGO, CAL.—Bids were opened on Nov. 19 as follows by the Board of Public Works for the construction of a bridge over Chollas Creek: CHARLES STEFFGEN, San Diego, $5,000 (awarded contract); Atlantic, Gulf & Pacific Co., $6,137; H. G. Fenton, $6,590; West Coast Construction Co., $6,390; J. W. Freeman, $7,656; Solon Bryan, $7,-345; John Engebretson, $6,730; Willcox Wrecking Co., $6,752. A. E. Crowell is City Engr.

LOS ANGELES, CAL.—Bids will be received by C. G. Keyes, Clk. Bd. of Supervisors of Los Angeles County, until 2 p. m., Dec. 7, for the construction of a reinforced concrete bridge over Santa Anita wash, on White Oak Ave. in the Lamanda road district.

VISALIA, CAL.—We are officially advised that J. M. NELSON has been awarded the contract for the construction of cement bridge here at $5,100. M. L. Weaver, Visalia, is Design. Engr.

SALT LAKE CITY, UTAH.—Bids will be received by the Board of Public Works until 8 p. m., Jan. 8, for constructing a steel or concrete highway bridge across the Jordan River at North Temple St. Instructions to bidders, together with specifications and forms for contract and bond, can be obtained upon application at the office of the Board of Public Works or City Engineer. Louis C. Kelsey is City Engr.

TORONTO, ONT.—The cost of the proposed viaduct from Niagara St. over the railway tracks to Garrison Commons has been estimated by C. H. Rust, City Engr., at $165,000.

BUILDINGS.

(• denotes that this work is advertised in Engineering News.)

FALL RIVER, MASS.—The County Commissioners have awarded the contract for the District court-house to BEATTIE & WILCOX, of this city, for $64,000. The JOHN F. JOHNSTON CO. secured the contract for heating and ventilating at $3,534, and WILLIAM KENNEDY the plumbing at $4,153.

FORT GREBLE (Saunderstown post-office), R. I.—Bids are asked until 10 a. m., Dec. 14, by Capt. Willis C. Metcalf, Q. M., for the construction of one company barrack and two double N. C. O. quarters at Fort Greble, R. I., including plumbing, heating and electric wiring.

STAMFORD, CONN.—Plans have been prepared by Boring & Tilton, Archs., 32 Broadway, New York, for a 2½-story high school building for the Board of Selectmen, J. G. Haughton, Chn., Stamford. Cost, $55,000.

•NEW LONDON, CONN.—Bids are asked until 10 a. m., Feb. 10, by Major R. M. Schofield, Constr. Q. M., New London, for constructing one double barrack, one single barrack, two Field Officers' quarters, one 4-set officers' quarters, two Lieutenants' quarters, three double non-commissioned officers' quarters, and one double firemen's quarters, at Fort Terry (Plum Island) N. Y., and two double barracks, two field officers' quarters, four Lieutenants' quarters, two double non-commissioned officers quarters, and two double firemen's quarters, at Fort H. G. Wright (Fishers Island), N. Y., and for plumbing, electric wiring and installing heating plants in same.

NEW YORK, N. Y.—Bids are asked until 3:30 p. m., Dec. 14, by C. B. J. Snyder, Supt. of School Bldgs., for new fireproof main stairs, new main storm enclosure, etc., at Public School No. 2, on the easterly side of Third Ave., between 169th and 170th Sts., Boro. of the Bronx; for forming and equipping cooking room in Morris High School, 166th St., Boston Road and Jackson Ave., Boro. of the Bronx; for work, etc., required to repair fire damage, at Public School No. 20, corner of Sanford Ave. and Union St., Flushing, Boro. of Queens; for the general excavation, etc., Contract No. 1, of Washington Irving High School, on the easterly side of Irving Pl., between 16th and 17th Sts., Boro. of Manhattan.

NEW YORK, N. Y.—We are officially advised that William C. Hazlett, Arch., 1133 Broadway, has completed plans, which have been approved by the Buildings Department, for a 43-story building to be erected at 50 Broadway, by the Broadway & New Street Realty Co., 50 Broadway, at a cost of $3,-875,000. The building will be constructed of white enamelled brick and terra cotta. When the owners are prepared to start construction, estimates for the work will be taken.

Plans have been filed for a 6-story apartment house with 35 suites of apartments, to be built for James O'Brien and M. Cravatta, 647 Sixth Ave., owners, at the corner of Broadway and 164th St. It is to be of the Renaissance type, with mezzanine bays and facades of brick, and trimmings of limestone and terra cotta. The Broadway frontage will be 100 ft., and the depth 90 ft. It is to cost $175,000. Denby & Nute, 333 Fourth Ave., are Archs.

The following bids were received on Nov. 24 by John F. Ahearn, Pres. Boro. of Manhattan, for furnishing all the labor and materials required for the erection and completion of a new heating system in the Headquarters Building and New Annex, located at Nos. 157 and 159 East 67th St.: Baldwin Engineering Co., 107 West 17th St., New York City, $14,900; John Hanken & Bro., $16,366; William J. Olvaney, $18,544; E. Rutzler, $17,318; J. C. Stewart, $21,770; Rainler Heating Co., $17,877; Daniel J. Rice, $20,312; Frank Dobson, Inc., $16,872; Blake & Williams, $16,930.

NEW YORK, N. Y.—Bids are asked until 10.30 a. m., Dec. 10, by Nicholas J. Hayes, Fire Comr., for furnishing all the labor and materials required for the erection and completion of a new building, hose rack and storage shed for an engine company to be located on the northerly spur of the lying-up slips of the St. George Terminals, Boro. of Richmond.

Plans have been filed with the Buildings Superintendent for remodelling the side extension of the Gorham Co. building, at the corner of Fifth Ave. and 36th St., and improving the lighting and ventilation by building new windows on the second, third, fourth, fifth and sixth stories, finished with wire glass and metal frames and basker grilles. The improvements are designed by McKim, Mead & White, Archs., 160 Fifth Ave.

We are advised by Neville & Bagge, 217 West 125th St., that estimates are being taken by Henry Schiff, 320 West 113th St., for a 12-story brick and stone apartment to be erected on 88th St., 100 ft. east of Riverside Drive. The building will be 100 × 83.2 ft. and will cost $525,000.

The Lawyers' Title Insurance & Trust Co. is having plans prepared by Clinton & Russell, Archs., 32 Nassau St., for alterations to the 11 and 12-story buildings it formerly occupied at 37 Liberty St. and 46 Maiden Lane. The floors used by the company itself had been arranged to suit its own purposes, and will now be made more available for general offices. The entrances on both streets will be altered and enlarged, and the large interior court probably will be rebuilt. The work is to be finished before May 1.

L. F. J. Weiher, Arch., 103 East 125th St., advises us that the Broad Construction Co., 516 West 162d St., is taking estimates for a 6-story brick and stone apartment building to be erected on St. Nicholas Ave., between 158th and 159th Sts., west side. The building will be 203.3 × 34.7 ft. and 70.9 ft. and will cost $200,000.

NEW YORK, N. Y.—Bids were received as follows on Nov. 27 by Robert W. Hebberd, Comr. Dept. Public Charities, for the cooking service equipment (including refrigerators), gas and electric fixtures and fitting up (other than that of closets and linen rooms) and all other work as set forth in the drawings and specifications, for the erection and entire completion of a residence for the superintendent, a residence for the medical staff, and a dining hall and kitchen building, in connection with the City Hospital at Blackwell's Island: J. M. Knapp, 230 West 19th St., $33,910; Cowden & De Young, 1123 Broadway, $33,452; Duparquet, Hust & Moneuse, 43 Wooster St., $32,500.

BUFFALO, N. Y.—At a meeting of the Trustees of the Chautauqua Institution, held in this city last week, an expenditure of $69,000 was authorized for business buildings on the Assembly grounds at Chautauqua, N. Y., to replace buildings burned recently. A "Colonnade" arcade building to cost $40,000; post-office and institution printing house building to cost $25,000, and arts and crafts building, $4,000. George E. Vincent, Chicago, is Pres.; Green & Wicks, 110 Franklin St., Buffalo, are Archs.

LEROY, N. Y.—J. Foster Warner, Arch., Granite Bldg., Rochester, has been retained to prepare plans for a high school building for the Board of Education, LeRoy. Cost, $80,000.

JOHNSTOWN, N. Y.—Competitive plans will be received by the Board of Education until Dec. 10 for the proposed high school building, for which an appropriation of $64,-000 was recently voted.

INDUSTRY, N. Y.—Bids are asked by Miss Laura E. Aldridge, Pres. Bd. of Mgrs. of the New York State Agricultural and Industrial School, until 7 p. m., Dec. 8, for the construction complete, including heating, plumbing and electric work, of an addition to industrial building, Hospital for Contagious Diseases, four cottages for boys and five cottages for employees. Franklin B. Ware, Capitol, Albany, is State Arch.

BUFFALO, N. Y.—Plans are in preparation for the erection of a municipal hospital for the treatment of contagious diseases at a cost of $250,000. The Board of Aldermen, acting on the recommendation of the Mayor, has voted that a bill be introduced in the State Legislature enabling the city to issue bonds for this purpose to the amount named.

ATLANTIC CITY, N. J.—Robert M. Catts, Land Title Bldg., Philadelphia, has retained Milligan & Weber, Archs., 520 Walnut St., Philadelphia, to prepare plans for a 9-story hotel to be built here. The estimated cost of the structure is $1,000,000.

PASSAIC, N. J.—John F. Kelly, Arch., Post-Office Bldg., let general contract to E. M. WALDRON & CO., 84 South Sixth St., Newark, N. J., for a 2-story parochial school building for St. Nicholas Parish, Rev. T. J. Kernon, Rector, at $60,000.

EAST ORANGE, N. J.—We are officially advised that Eugene A. McMurray, 22 Clinton Ave., Newark, and W. Pell Pulis have prepared plans for a 16-family apartment house, to be erected on William St., East Orange, by James J. Allen. The building will be brick, four stories, 50 × 102 ft. The estimated cost is $40,000. Estimates are being taken.

HAZLETON, PA.—Bids were received as follows Nov. 25 at the office of the Supervising Architect of the Treasury, Washington, for the construction of a post-office building at Hazleton, Pa.: Durolithic Co., Buffalo, $48,283; M. P. Wells, Philadelphia, $51,327; George A. Glenn & Co., Philadelphia, $49,494; Ambrose B. Stannard, New York City, $52,600; William H. Bissell & Co., $54,000; Wilmarth Building Co., New York, $49,856; William R. Compton Realty & Building Co., Elmira, N. Y., $55,201; Ahrens Construction Co., Inc., Lewistown, Pa., $62,800; J. E. & A. L. Pennock, Philadelphia, $48,787; Robt. S. Rathbun, Allentown, Pa., $48,823; Carlucci Stone Co., Scranton, Pa., $47,600; E. H. Tichener & Co., Binghamton, N. Y., $59,985; Walter Titus, Philadelphia, $52,000.

PITTSBURG, PA.—George W. Guthrie, Mayor, has awarded the contract for the erection of the proposed hospital building at the poor farm at Marshalsea to DUSHANE & LEWIS, Pint St., Carnegie, Pa. The contract price was $64,336. The successful bidders were the lowest of the 20 concerns that submitted bids. The building will be two stories in height, of fireproof construction, and will be equipped with all modern appliances. The general contract also includes the sub-contracts, which will be awarded later.

PITTSBURG, PA.—Press reports state that the building of St. Joseph's Hospital will be torn down within a short time to be replaced by a $135,000 structure at No. 2117 Carson St., South Side.

PHILADELPHIA, PA.—Richard C. Loos, Arch., 1017 Chestnut St., has let contract to ROBBINS & CO. for rebuilding 4-story club house for the Fraternal Order of Eagles at $50,000.

The Board of Education, William Dick, Secy., is having plans prepared by J. Horace Cook, Arch., for three 3-story schools to cost $500,000 and one 3-story school to cost $300,000, respectively.

Henry W. Wilson, Arch., Drexel Bldg., has been commissioned to prepare preliminary sketches for an apartment house, 99 × 150 ft., at 49th St. and Florence Ave. It is to be four stories high and to contain 15 flats and one store. The estimated cost is $75,000.

Albert J. Sanders, Land Title Bldg., has completed negotiations for the erection of a building at 1926 to 1932 Arch St. for the Gregg Carriage Co. Including the cost of the ground and the building, work upon which will be started at once, the new structure will linvolve an expenditure of about $100,000. The new building will be four stories high, of slow-burning construction, with a front of brick and terra-cotta. It will have a frontage of 52 ft. on Arch St. and a depth of 150 ft., and will contain 40,000 ft. of floor space, extending to Cuthbert St. It was planned by Henry E. DeHoff.

J. T. Windrim, Arch., Commonwealth Bldg., Philadelphia, is preparing preliminary plans for interior alterations and a 4-story addition to the Wills Eye Hospital. Cost, about $75,000.

MEADVILLE, PA.—The contracts for the plumbing, steam heating and roofing for the new federal building here have been awarded to the L. L. LORD CO., of this city. The contract for the steel work has been awarded to BELMONT IRON WORKS, of Philadelphia. The contract for electrical wiring and electrical fixtures was awarded to E. P. STRANG, Philadelphia. The marbie to the VERMONT MARBLE CO., and granite to the BALTIMORE STONE CO. The general contract was awarded several weeks ago to MARK P. WELLS, of Philadelphia, who awarded the above contracts. The total cost of the building will be about $200,000.

CONNELLSVILLE, PA.—The Directors of the Second National Bank, which is building a $150,000 building here, have awarded the following sub-contracts: Vaults and safes, to the UNITED STATES SAFE CO., of Pittsburg; marble work to the EVANS MARBLE CO., Baltimore; metal furniture, to the ART METAL CONSTRUCTION CO., Jamestown, N. Y.; cabinet and carpenter work, to A. & S. WILSON, Pittsburg; bronze and ornamental work, to JOHN WILLIAMS, INC., New York, and revolving doors to the VAN KENNELL REVOLVING DOOR CO., of New York.

WILMINGTON, DEL.—We are officially advised that the contract for constructing School No. 11, a 2-story building, 31 × 92 ft., has been let to JOHN E. HEALY. E. L. Rice & Co., 815 Market St., Wilmington, are Archs.

MILFORD, DEL.—Bids were received as follows Nov. 27, at the office of the Supervising Architect of the Treasury, Washington, D. C., for the construction of a post-office at Milford, Del.: J. E. & A. L. Pennock, Philadelphia, $41,847; Calvin W. Rogers, Philadelphia, $44,742; A. S. Reed & Bro., Wilmington, Del., $39,700; Lynch Bros., Lippincott Bldg., Philadelphia, $34,492; M. P. Wells, Philadelphia, $38,977; V. M. D. Harrington, Milford, Del., $35,620; Fred A. Havens & Co., Philadelphia, $39,837; Ambrose B. Stannard, New York, $40,000; George A. Glenn & Co., Philadelphia, $36,925; W. H. Fissell & Co., New York, $44,391; David M. Andrews Co., Baltimore, $38,500.

WASHINGTON, D. C.—Bids were received as follows Nov. 30 at the office of the Superintendent of Construction of the U. S. National Museum Building, Washington, for 220,000 ft. B. M. of Georgia pine dressed flooring lumber: William D. Gill & Sons, Baltimore, heart face, $69.25 per M. ft. B. M.; $66, 2¼-in. heart face; $57.50, A quality sap rift; $54.50, 2¼-in. sap rift. W. A. Church, Washington, $65 on specifications; $53, "A" sap rift. G. Elias & Bro., Buffalo, $97.50 on specifications; $75. 2—14-in. sap rift.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have awarded contract for the construction of an extension to the McKinley Manual Training School, to the GEORGE A. FULLER CO., Munsey Bldg., Washington, at $52,800.

MANCHESTER, VA.—Bids were received as follows on Nov. 30 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, for the construction of a post-office at Manchester, Va.: R. H. Richardson & Co., Hampton, Va., $48,934; D. J. Phippe, Newport News, Va., $47,900; Pavarini & Wyne, Washington, D. C., $47,900; J. W. Hall, Richmond, Va., $56,800; James F. Bradley & Co., Richmond, Va., $44,900; Ambrose B. Stannard, St. James Bldg., New York, $47,000; Alexander Paxson, Manchester, Va., $61,633; W. M. Seay & Son, Petersburg, Va., $50,800; Barnes Bros., Hamilton, Ohio, $40,300; Wilmarth Building Co., New York, $44,686; King Lumber Co., Charlottesville, Va., $43,330; Harrison Construction Co., Petersburg, Va., $55,156. Time, Dec. 31, 1909.

CHARLOTTESVILLE, VA.—John K. Peebles, Law Bldg., Norfolk, has prepared sketches for the Law building for the University of Virginia, Charlottesville. Cost, $60,000.

ATHENS, ALA.—The Commissioners of Limestone County have awarded contract to the FALLS CITY CONSTRUCTION CO., Louisville, Ky., for erection of court-house, 110 × 80 ft., stone, steel and concrete fireproof, with steam heat and electric lighting. Estimated cost, $59,000. The Falls City Construction Co. prepared plans. George Malone, Judge of Probate.

NEW ORLEANS, LA.—Press reports state that plans are under way for the erection of a cotton-holding warehouse on the river front in or near New Orleans, to cost about $1,750,000. It is said a tract of land comprising 400 acres is being negotiated for. J. E. Hines, of Kansas City, Mo., is interested.

MEMPHIS, TENN.—According to the Memphis "Commercial Appeal," the Memphis Railroad Terminal Co. will erect a union station here to cost $3,000,000. John H. Watkins is Pres.; W. H. Harrison is Ch. Engr.; James H. Malone is Mayor of Memphis.

CHATTANOOGA, TENN.—The Stone Fort Land Co. will erect a 5-story brick mercantile building, with basement, at Market and A Sts. Size, 50 × 100 ft. W. T. Downing, James Bldg., Chattanooga, is Arch.

GALLATIN, TENN.—We are officially advised that G. L. Lockhart, Stahlman Bldg., Nashville, Tenn., has prepared plans for a 3-story and basement hotel, 100 ft. square, for S. J. Fletcher, Gallatin. Estimated cost, $40,000. The masonry contract has been let to W. G. BUSH & CO., and the steel work to the NASHVILLE BRIDGE CO., both firms of Nashville.

LOUISVILLE, KY.—McDonald & Dodd, Archs., Equitable Bldg., are preparing plans for a 7-story hotel for the Tyler estate, care Owen Taylor. Cost, $150,000.

CLEVELAND, OHIO.—It is stated that a building, not less than 15 stories high, will be erected on the site of the Republic Building, 647 Euclid Ave., as the result of leasing that property by Henry Boehmke to the Tenbusch Realty Co. The structure will cost over $700,000.

The following bids were opened on Nov. 24 by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C. for installing elevator system in the court-house and custom house at Cleveland, Ohio: Otis Elevator Co., 17 Battery Pl., New York, $38,475; Marine Engine & Machine Co., New York City, $39,524; Llewellyn Iron Works, Los Angeles, Cal., $41,221.

GARY, IND.—Edward Tollman has ordered plans for the erection of a flat building on Virginia Ave. Bids will be received by A. F. Hinkle, Arch.

INDIANAPOLIS, IND.—The Southerland Presbyterian Church has taken steps to build a church on Southerland Ave, John C. Hamilton, F. E. Kline and George W. Stitz are Trustees.

Bids are asked until Dec. 8 by John E. Cleland, Business Dir., School Bd., for the remodeling and the construction of an addition to the Manual Training High School on South Meridian St. Adolph Scherrer is Arch., Indiana Trust Bldg.

INDIANAPOLIS, IND.—D. A. Bohlen & Son, has let mason contract to JOHN A. SCHUMACHER for a 4-story lodge building for the Murat Temple Association. Cost, $250,000.

ELKHART, IND.—Bids are asked until Jan. 2 by the Trustees of the Presbyterian Church for the erection of a church. Plans now ready for bidders.

EVANSVILLE, IND.—Bids are asked until Jan. 2 by the Board of Control, Miss Mary Collson, Chn., for the erection of a Christian Scientist church on Mulberry St.

DETROIT, MICH.—We are officially advised that George W. Graves, Arch., Cleveland Bldg., has prepared plans for a 3-story family hotel and club house, 70 × 185 ft., to cost $60,000. There will be three buildings and estimates will be received until about Dec. 5.

AURORA, ILL.—Worst & Shepardson, Archs., have let contract for concrete work to DOAN & ARMBRUSTER for the 3-story Y. W. C. A. building, to cost $50,000.

CHICAGO, ILL.—Estimates will be received by Marshall & Fox, First National Bank Bldg., until Dec. 7 for the superstructure of the Blackstone Hotel for the Drake Hotel Co. Cost, $1,500,000.

Henry Phipps is planning the construction of an apartment house at the corner of 53d St. and Jefferson Ave. The cost is estimated at $115,000. The building will front 250 ft., will be three stories high, and will have interior courts. The architects are Jenney, Mundie & Jenson, New York Life Bldg. The apartments will be of four, five and six rooms.

SHEBOYGAN, WIS.—We are officially advised that Paul V. Hyland, Arch., Heyworth Bldg., Chicago, is preparing plans for a bank building, 52 × 98 ft., for the Bank of Sheboygan. The building will cost $60,000 and contracts will be let about Jan. 1. It will be of slow burning construction, with a front of Bedford stone, marble and granite.

MILWAUKEE, WIS.—Competitive plans will be received by F. O. Phelps, Clerk Bd. of Supervs. of Milwaukee County, until 2 p. m., Jan. 14, for a detention home and juvenile court building, to be erected at Galena and Eleventh Sts. The successful competitor will be appointed superintendent and architect of the proposed building.

ST. PETER, MINN.—The State Board of Control, P. M. Ringdal, Chn., St. Paul, Minn., has rejected all bids for the construction of a hospital for the criminal insane at St. Peter. Cost, $65,000. C. H. Johnston, Manhattan Bldg., St. Paul, is Arch.

DULUTH, MINN.—The following bids were received on Nov. 23 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for an electric passenger elevator in the U. S. post-office, court-house and custom-house, Duluth: Llewellen Iron Works, Los Angeles, Cal., $5,950; Otis Elevator Co., New York, N. Y., $4,391, and Marine Engine & Machine Co., New York, N. Y., $5,747.

MINNEAPOLIS, MINN.—The BRAYTON-ENGINEERING CO. has secured the general contract to erect the Security warehouse building at Seventh Ave., N., and First St. It will be of reinforced-concrete fireproof construction, Turner mushroom system, with pressed brick and cut stone trimmings, 60 × 150 ft., 8-story and basement. Bell & Edwins are Archs.

NEWTON, KAN.—Bids were received as follows Dec. 1 at the office of the Supervising Architect of the Treasury, Washington, D. C., for the construction of a post-office at Newton, Kan.: Wurster Construction Co., Wichita, Kan., $47,412; Parsons Kirne, Omaha, Neb., $49,541; M. Yeager Son, Danville, Ill., $49,966; Cook Construction Co., Des Moines, Iowa, $61,882; E. A. Steininger Construction Co., St. Louis, Mo., $52,758; Deiter Wenzel Construction Co., Wichita, Kan., $48,760; Carl A. Wilson, Kansas City, Mo., $43,070; F. H. Latimer, Kansas City, Mo., $53,842. Time, Jan. 1, 1910.

OMAHA, NEB.—The International Harvester Co. will begin the erection of its $65,000 brick warehouse at 805 and 811 Capitol Ave. immediately. The building is to be six stories high. E. S. Pine of Chicago, is Arch. McGOWAN & JACOBBERGER, of Omaha, are the contractors.

*CHEYENNE, WYO.—Bids are asked until 9.30 a. m., Dec. 21, by Capt. V. K. Hart, Acting Q. M., Cheyenne, for constructing at Fort D. A. Russell, Wyo., buildings specified below, and for plumbing, steam heating, electric wiring and electric fixtures in buildings requiring same. Quarters: for one Brigadier General, three Field Officers, seven double Captains, three double Lieutenants, one Bachelor Officers, two double N. C. Staff Officers and two double Cavalry barracks; four Cavalry stables, one Field Staff and Band stable, two fire stations, one guard house, two Quartermaster's workshops, two coal sheds, one hay shed, two granaries, two quartermaster's storehouses, and two subsistence storehouses.

ST. LOUIS, MO.—The Shepley Estate has had plans prepared by Mauran, Russell & Garden, Archs., Chemical Bldg., for a 2-story, Bedford stone building, 100 × 120 ft., to cost $50,000. The lower floor will contain five stores and the upper floor offices.

Mrs. Elizabeth Gerhard, Duncan St., who owns the block bounded by Forest Park Boulevard, Taylor Ave. and Duncan St., will improve the Forest Park Boulevard front with residences, to cost about $50,000.

Martin Shaughnessy, 216 Ozark Bldg., has awarded contract to MORITZ EYSSELL, Odd Fellows Bldg., St. Louis, for erection of a residence. It will have 2½ stories, hot-water heat, electric lighting. Cost, $50,000. Barnett, Haynes & Barnett, Frisco Bldg., St. Louis, are Archs.

The Berger Investment Co. has purchased site with frontages of 335, 333 and 297 ft., on which it is proposed to erect an apartment house. The company will build 75 apartments of four and five rooms. Estimated cost, $150,000. Isaac Taylor, 715 Locust St., is Arch.

ST. LOUIS, MO.—The Mississippi Valley Trust Co. has had plans prepared by Theodore C. Link, 308 North Sixth St., for proposed limestone mercantile building to be occupied by Roberts, Johnson & Rand Shoe Co. The building will have ten stories and sub-basement, 107 × 133 ft., fireproof, skeleton steel-frame work and a total floor space of 150,000 sq. ft. Cost, about $560,000.

Plans have been completed by J. W. Leigh, and work is to be begun at once on an improvement for the corner of Blackstone and Julian Aves., which will represent an expenditure of about $100,000. The site has a frontage of 270 ft. on Blackstone and 120 ft. on Julian Aves. and has been purchased by the Leigh Bros. Real Estate & Investment Co.

SAN ANTONIO, TEX.—Southern Pacific Co., W. G. Van Vleck, Houston, Tex., Mgr. of Texas Lines, has awarded contract to BROOKS-GORDON CONSTRUCTION CO., of Houston, Tex., for erection of a freight depot in San Antonio. It will be built of reinforced concrete and will consist of two buildings, each 385 ft. long and 75 ft. wide, one for loading and other for unloading. Estimated cost, $100,000.

CHICKASHA, OKLA.—Hair & Smith, of Salina, Kan., have let general contract to CRITES & BEATTY, Kansas City, Mo., for a 3-story city hall for the city of Chickasha.

OKLAHOMA CITY, OKLA.—The Board of Education has selected Layton & Smith, of this city, as architects for the proposed $300,000 high school building. Frank J. Merrill is Chn. Bldg. Com.

DENVER, COLO.—The Dime Investment Co. will erect an office building to cost $300,000, it is stated.

SEATTLE, WASH.—L. L. Lewis has taken out a permit to build an apartment house at 1007 East Marion St. from plans prepared by Graham & Meyers, Archs., Lowman Bldg. The building will cost $65,000.

SPOKANE, WASH.—It is stated that the Luger Furniture Co. is to erect a warehouse in Spokane next spring. The building will be 100 × 100 ft., with a 2-story sample house and the cost will be about $100,000.

REDONDO, CAL.—The San Francisco "Chronicle" states that H. E. Huntington has announced that he will begin construction of a bathhouse at once. The building will cost $150,000, will have four stories and basement, 278 ft. long and 107 ft. wide. There will be four pools, the largest 70 × 157 ft., and a hot water supply of 2,000,000 gallons daily will come from the condensers of the Huntington power plant. The equipment will include 1,350 dressing rooms and 62 private bathrooms. C. H. Burnett, Redondo, is interested.

SAN FRANCISCO, CAL.—A 10-story Class A structure is to be built on the corner of O'Farrell St. and Bagley Pl. by Kohler & Chase, 1385 Sutter St., and work upon the building is to be begun at [illegible] Cost, $100,000.

Plans have been completed for a 6-story business building for G[illegible] Co., 1242 Van Ness Ave., [illegible] Bowen & [illegible] the site of the firm's old [illegible] erected on [illegible] fire. The building will cost [illegible],000. Myers & Ward are Archs.

It is stated that a 20-st[illegible] be built to the St. Francis [illegible] addition is to [illegible] The addition [illegible] Mgr.; Bliss & Favill, 1[illegible] Woods is [illegible] Archs.

OAKLAND, CAL.—A [illegible] is to be erected for Charles J. Stev[illegible] yard facing Lake Merritt, [illegible] the boulevard. The building is to be $47,000. [illegible] cost of the [illegible] are the E. H. Kueffer Co. [illegible] architects.

SAN FRANCISCO, CAL. [illegible] the erection of the Mission Grammar [illegible] Five bids were received on Nov. 18 [illegible] Board of Public Works, the lowest [illegible] being the Kittle Construction Co., S[illegible] & Stockton Sts., which submitted a b[illegible] $112,950 for smooth stone finish construc[illegible] and another of $101,500 for rough finish.

THREE RIVERS, QUE.—A [illegible] market building, costing about $40,000 [illegible] be erected at Three Rivers, Que. Th[illegible] Daoust & the Arch. and M. BIGRAS, [illegible] Rivers, is the contractor.

TORONTO, ONT.—The T. [illegible] Co. have applied for a permit to build a [illegible]-story addition to the north section of [illegible] Yonge St. store at a cost of $76,000.

WINNIPEG, MAN.—W. [illegible] Blair, Arch., Northern Bank Bldg., has prepared plans for an apartment block to be erected here for Dr. R. I. [illegible], Canada Life Bldg. Cost, $125,000.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

LAWRENCE, MASS.—The contract for 368 tons of water pipe, bids opened on Nov. 24, has been awarded by the Water Board to LYNCHBURG FOUNDRY CO., 220 Broadway, New York, at $23.45 per ton. M. F. Collins is Supt. W.-Wks.

SHELBURNE FALLS, MASS.—E. E. Davis of Northampton is making surveys for the construction of a gravity water supply system. W. S. Ball is Secy. Com.

NEW BEDFORD, MASS.—The Water Board on Nov. 24 awarded the contract for furnishing pipe and castings to the U. S. CAST IRON PIPE & FOUNDRY CO., 71 Broadway, New York, at $12,449.

FORT GETTY, R. I.—Bids will be received by Capt. Willis C. Metcalf, Q. M., U. S. A., Newport, until 10 a. m., Dec. 7, for the construction of water supply and sewer systems at Fort Getty.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Dec. 10, by the Park Board for furnishing all the necessary labor and materials for excavating, depositing mold, sodding and installing water supply in the addition to Riverside Park at 122d St. Borough of Manhattan. Henry Smith is Pres. Bd.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Dec. 16, by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing and delivering corporation cocks, being contract abandoned by the Southern Brass Works, Inc. The quantities of supplies required are as follows: 5,065 ¾-in. corporation screw cocks, with tail pieces, complete; 200 ¾-in. corporation screw cocks, with tail pieces, complete; 500 1-in. corporation screw cocks, with tail pieces, complete; 250 2-in. corporation screw cocks, with tail pieces, complete.

FORT SLOCUM (New Rochelle post-office), N. Y.—The DECCICO CONTRACTING CO., Larchmont, N. Y., has been awarded the contract for the extension of the water distributing system here.

BRIDGEPORT, PA.—The Mount Pleasant Water Co., Mount Pleasant, Pa., has engineers making surveys and preparing plans for the enlargement and improvement of the storage reservoirs here. The water company is a subsidary concern of the H. C. Frick Coke Co., of Pittsburg.

EBENSBURG, PA.—The Pennsylvania R. R. Co., Philadelphia, is negotiating for the purchase of the George Roberts farm and water rights near this place. It is the intention of the railroad company to commence the construction of a large storage reservoir next summer in case a site can be secured. This will be used in connection with similar reservoirs that have been built in various parts of western Pennsylvania.

*READING, PA.—Bids were opened as follows on Nov. 24 by the Board of Water Commissioners for building about 8,000 ft. of 60-in. reinforced conduit and appurtenances for raw water for Maiden Creek sand filters: S. W. CHILDS and W. A. WITMAN, Reading, $40,848 (awarded contract); Fehr & O'Rourke, $41,747; Timothy J. O'Connell, $41,868; George H. Meinholtz, $48,247; King, Rice & Ganey, $49,324; P. Vinnow, $50,571; Booth & Flinn, Ltd., $53,324; Thomas H. Riddle, $54,640; Hawman Construction Co., $54,816; Standard Construction Co., $65,637; H. E. Ahrens Co., Reading, $67,165; Nolan Bros., $78,549; J. P. O'Reilly, $73,784; David Peoples, Betz Bldg., Philadelphia, $85,595. Lincoln S. Ramsey is Secy. Bd.

*PITTSBURG, PA.—We are officially advised that contracts have been awarded as follows by the Department of Public Works for furnishing and installing equipment in the extension of the filtration works: Contract 11-A, to W. H. OCHILTREE, 210 Third St., Pittsburg, at $23,816; Contract 11-B, to BEST MFG. CO., 25th St., Pittsburg, $26,148; Contract 11-C, to PITTSBURG VALVE, FOUNDRY & CONSTRUCTION CO., 26th St., Pittsburg, $3,290; Contract 11-F, to McGINNESS-SMITH CO., 217 First Ave., Pittsburg, $3,135; Contract 11-G, to THOMAS CARLIN'S SONS CO., 1600 River Ave., Pittsburg, $3,495; Contract 11-H, to RODGERS SAND CO., foot of Fifth St., Pittsburg, $75,268. Bids were opened on Nov. 23. Alex. B. Shepherd is Acting Dir. Pub. Wks.

*WILMINGTON, DEL.—The Board of Water Commissioners on Nov. 25 awarded the contract to COLEMAN BROS., 15 Court Square, Boston, Mass., for the construction of a covered slow sand filtration plant together with filter water reservoirs, filter sand washing apparatus and other appurtenances, at $257,500. A. Kienle is Ch. Engr. Bd. List of bidders noted last week.

BALTIMORE, MD.—J. Barry Mahool, Mayor, has appointed Frederick Pike Stearns, Boston, Mass., and John Ripley Freeman, Providence, R. I., as advisory engineers for the construction of the 20,000,000,000-gallon reservoir in the Gunpowder River valley, for which $5,000,000 of bonds have been voted, the site comprising between 3,000 and 4,000 acres, and the addition to the lake will include a certain part of a watershed, which will be reforested. The tentative plans consist of the construction of a dam 80 ft. high and 500 or 600 ft. long, construction of waste channel to and around and below present dam, building of tunnel four miles long to Lake Roland, stripping of slope of lake to prevent corrosion, etc. Alfred M. Quick is Water Engr.

*WASHINGTON, D. C.—The following bids were opened on Nov. 21 by the Commissioners of the District of Columbia, for an auxiliary water system and fire protection for the Home for the Aged, subdivisions of Bellevue and Blue Plains, District of Columbia.: G. W. Mfg. Co., 26 Cortlandt St., New York, $11,943; P. H. & J. Conlan, Newark, N. J., $16,250; McCay Engineering Co., 9 East Lexington St., Baltimore, Md., $13,734.

PARSONS, W. VA.—The city has engaged Penniman & Fairley, Consult. Engrs., 411 Marine Bank Bldg., Baltimore, Md., to prepare plans for constructing water-works, for which $30,000 of bonds have been voted. H. L. Bennett is Mayor.

MARSHALL, N. C.—The Board of Internal Improvements on Nov. 25 awarded the following contracts for the water-works system: Contract No. 1, for installing approximately 1,500 ft. of 6-in., 3,000 ft. of 4-in. water pipe, ten Ludlow fire hydrants and all necessary valves, fittings, etc., to BALL, THRASH & CO., of Asheville, N. C. Contract No. 2, for building a concrete reinforced reservoir, to be 10 ft. deep, 50 ft. long and 20 ft. wide, to COLVIN & DAVIDSON, Asheville, N. C. Contract No. 3, for drilling one 8-in. well to SCHANK & MILLIRON, Asheville, N. C. All work to begin at once and be completed in 90 days. The Board has not yet decided whether an air-lift pump will be used or a deep well pump, and parties interested in these systems are requested to write the engineer. Dudley Cludey is Engr.

*AUGUSTA, GA.—The Water-Works Committee of the City Council on Nov. 24 awarded the contract for the new steam pump, capacity 6,000,000 gallons daily, as follows: Boiler, to LOMBARD IRON WORKS, Augusta, $3,388; engine and pump, to the WILSON-SNYDER MFG. CO., 2 Ross St., Pittsburg, at $10,825. Nisbet Wingfield is City Engr.

MARIETTA, GA.—The citizens on Nov. 16 voted to issue $80,000 of bonds for the construction of water-works.

PALMETTO, FLA.—The city will ask for bids about Jan. 1 for the construction of water-works for which $15,000 of bonds have been voted.

CUMBERLAND GAP, TENN.—The East Kentucky Land Co. has applied to the town for a 20-year water franchise. This company proposes to construct a new water system, laying larger mains and building a concrete reservoir on the mountain side.

JELLICO, TENN.—J. B. McCrary & Co., of Atlanta, Ga., are preparing preliminary surveys, plans and specifications for the construction of water-works. S. P. Snyder is Mayor.

COVINGTON, KY.—Bids will be received by the city until Dec. 10 for laying water mains along the principal streets of the town of West Covington.

UNIONTOWN, KY.—The city will construct water-works, and wants estimates on water-works machinery and supplies. G. F. Cecil Mgr. Union Light & Power Co., is interested.

PORTSMOUTH, OHIO.—The Board of Public Service has been authorized to contract with Samuel M. Gray, of Providence, R. I., to prepare plans, estimates and for preliminary supervision of the construction of the proposed new water-works.

SALEM, OHIO.—The citizens on Nov. 21 voted in favor of issuing $131,000 of bonds for the purchase of the plant of the Salem Water-Works Co.

SCOTTSBURG, IND.—See item under Light and Power Plants.

CONNERSVILLE, IND.—Bids will be received until Jan. 12 by Jacob S. Clouds, City Clk., for furnishing material and constructing and leasing to the city, for a period of ten years, or not more than 25 years, certain improvements and additions to the city water-works and water supply.

COLFAX, ILL.—Bids will be received about Dec. 15 for the construction of water-works. Estimated cost, $12,000. J. S. Barnes is Village Clk.

CERRO GORDO, ILL.—George C. Morgan, 169 Jackson Boulevard, Chicago, Ill., is preparing plans for the construction of water-works, and bids for construction will probably be asked in February. Estimated cost, $18,000. John W. Vent is Chn. Water Com.

WINNETKA, ILL.—The Board of Local Improvements has awarded the contract to W. M. DAVIDSON, Wilmette, Ill., for constructing water mains in Church and Merrill Sts. Frank A. Windes is Village Engr.

DECATUR, ILL.—MERTZ & AMMAN, Decatur, have been awarded the contract for the construction of intakes, suction wells and appurtenances here. Daniel W. Mead is Consult. Engr., 738 First National Bank Bldg., Chicago, Ill.

SPIRIT LAKE, IOWA.—We are officially advised that the town has awarded the contract to the DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, for the construction of a complete water-works system, the work including a 75,000-gallon steel tank and tower, distribution pipe line system, small cement block building, motor-driven pump and system of drive points at $19,791. O. Claussen, German-American Bank Bldg., St. Paul, Minn., is Engr.

LAMONI, IOWA.—T. C. BROOKS & SONS, Jackson, Mich., have been awarded the contract for constructing a system of water-works for Lamoni. The W. K. Palmer Co. are Consult. Engrs., Dwight Bldg., Kansas City, Mo.

NEW ULM, MINN.—The City Council on Nov. 16 opened bids for the construction of the pipe line to connect the water mains on German St. with the proposed reservoir on the hill west of the Hermann monument. There were five bids covering the entire work and the furnishing of material, ranging from about $10,000 to $14,000. The CUDDY-CAVANAUGH CO., of this city, the lowest bidder, was awarded the contract. The main will be about a mile long and will consist of 14-in. pipe between German and Franklin Sts. and 12-in. pipe beyond that point.

HAYS, KAN.—Bids will be received about Dec. 20 for the construction of water-works here. Estimated cost, about $18,000. R. B. Orr Engineering Co., of Kansas City, Mo., are Engrs.

WILLISTON, N. DAK.—On Nov. 14 the Secretary of the Interior awarded contract for furnishing one 500-KW. turbine electrical generating unit for use in the power plant for the Williston and Buford-Trenton irrigation projects, North Dakota, to the ALLIS-CHALMERS CO., of Milwaukee, Wis., at $13,200.

KANSAS CITY, MO.—The National Land & Subirrigation Co., with $3,000,000 capital, was organized here on Nov. 21 with the following officers and directors: John L. Wiggins, of Dallas, Tex., Pres.; M. E. Yinger, Kansas City, Vice-Pres.; L. Underwood, Secy., and Oscar T. Gregory, Kansas City, Treas. The above named officers, together with H. E. Bell, of this city, and H. E. West, of Independence, Kan., are the directors. The company are soon to install experimental stations in Colorado, New Mexico, Arizona and southwestern Texas. These stations will be equipped with the Wiggins system of subirrigation.

OSCEOLA, ARK.—Bids will be received about Feb. 1 for the construction of water-works here, bonds for which have been sold. Estimated cost, $25,000.

AFTON, OKLA.—The W. K. Palmer Co., Dwight Bldg., Kansas City, Mo., are preparing plans for the construction of water-works here, bonds for which have been sold.

DENVER, COLO.—Contracts for the completion of the Standley Dam were awarded on Nov. 17 by the Denver Reservoir Irrigation Co. to the RENNESICK-QUIGLEY CO., of Kansas City, Mo. About 100,000 acres of fertile but semi-arid land near Denver will be irrigated.

LEADVILLE, COLO.—Plans have been adopted by the Government for the construction of a reservoir near here. The reservoir will be located in the East Fork River north of Leadville and will be used for irrigation purposes for the small towns below. When built it will be nearly four miles long and one mile wide. Ditches will be extended into Summit County and from here they will get nine sources of supply from Ten Mile Creek. Fourteen additional sources of supply will be gained from the head waters of the Eagle River. The reservoir will gather snow water from the Continental divide and Mosquito range. Capacity, 3,277,875,000 cu. ft. of water.

LAMAR, COLO.—The Board of Trustees has awarded the contract to the BOULDER IRON WORKS CO., Boulder, Colo., at $11,733, for constructing Section No. 1 of the water-works system, together with all appurtenances. C. W. Heaton is Clk. Bd.

WINLOCK, WASH.—The citizens on Nov. 11 voted to issue $15,000 of bonds for the construction of water-works. C. E. Lemard is City Clk.

SPOKANE, WASH.—Bids will be received until Dec. 8 by the Board Public Works, J. T. O'Brien, Secy., for constructing a steel force main, approximately four miles long.

ASTORIA, ORE.—Bids will be received by the city until Dec. 21 for the construction of 12,000 ft. of 24-in. concrete water pipe and about 1,300 ft. of steel water pipe.

SAN DIEGO, CAL.—We are officially advised that MARSHALL, BROWN & GALLAGHER, San Diego, have been awarded the contract by the Board of Public Works for the construction of a reinforced-concrete reservoir at $98,464. Bids were opened on Nov. 12. A. F. Crowell is City Engr.

SAN DIEGO, CAL.—The Board of Public Works on Nov. 18 awarded the contract to the BROWN, MARSHALL & GALLAGHER CO., of San Diego, for the construction of the University Heights reservoir at $97,713.

WINNIPEG, MAN.—Bids will be received by Magnus Peterson, Secy. of the Civic Board of Control, until 11 a. m., Feb. 22, for the supply and erection of turbine pump with electric motor for the city water-works. Specifications may be obtained from H. N. Ruttan, City Engr.

NORTH VANCOUVER, B. C.—The contract for supplying 10,000 ft. of 4-in. water pipe was awarded to the CANADIAN PIPE CO., at 19½ cts. per ft.

SEWERAGE.

FORT GETTY, R. I.—See item under Water Supply—Irrigation.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Dec. 16, by Bird S. Coler, Boro. Pres., for constructing sewers and sewer basins in various streets.

BATAVIA, N. Y.—Albert L. Webster, 88 Wall St., Rudolph Hering, 170 Broadway, New York, have completed the report covering the disposal of sewage for the village and have recommended the construction of a complete system of sewers and sewage disposal plant. Estimated cost, $367,000. The report has been referred to the Sewer Board, Myron H. Peck, Chn.

DEPOSIT, N. Y.—Alexander Potter, 143 Liberty St., New York City, has been selected to prepare plans for sewerage construction here. Calvin Onderdonk is Village Clk.

JERSEY CITY, N. J.—Bids were opened on Nov. 16 by the Board of Street and Water Commissioners for delivering and laying c.-i. water pipe, in all 13,000 lin. ft. 20 to 6-in. pipe and about 1,000 cu. yds. rock excavation. The contract has been awarded to BERNARD GANNON, 41 Graham St., Jersey City, at 93%.

DANVILLE, PA.—Bids will be received until Dec. 10 for constructing a sewage disposal plant at the State Hospital for the Insane here. Albright & Mebus are Engrs., Land Title Bldg., Philadelphia.

HAZLETON, PA.—It is proposed to construct a 15-in. terra cotta pipe sewer in Lincoln St. Estimated cost, about $3,500. B. E. Youngman is City Engr.

PHILADELPHIA, PA.—Bids will be received until Dec. 8 by Geo. R. Stearns, Dir. Dept. Pub. Wks., for constructing branch sewers, Schedule B.

DERRY, PA.—The lowest bid opened on Nov. 16 by the Borough Council for constructing 37,570 ft. pip: sewers from plans of J. J. Neel, of Greensburg, was submitted by Logan D. Burd, of Canton, Ohio, at the following prices: 73 ft. 20-in. sewer pipe, 72½ cts.; 1,572 ft. 18-in. sewer pipe, 63½ cts.; 2,203 ft. 15-in. sewer pipe, 56½ cts.; 3,058 ft. 12-in. sewer pipe, 50½ cts.; 5,632 ft. 10-in. sewer pipe, 46¼ cts.; 25,032 ft. 8-in. sewer pipe, 33 cts.; 18 manholes, each, $30; 55 lamp holes, each, $3.50. Total, $15,452. Other bidders were: D. J. Madigan & Co., Swissvale, $20,500; Thoney Pietro Co., Morgantown, W. Va., $17,696; George Waller & Co., West Pittsburg, $20,143; P. J. Flinn, Connellsville, $20,969; Thomas Arrigo, Charleroi, $24,279; Maynard & Flynn, Pittsburg, $16,871; John T. Emery, Youngwood, $18,320; Patsy Christmas, Brownsville, $26,405; Ott Brothers, Pittsburg, $16,820; M. O'Herron & Co., Pittsburg, $17,628; Thomas Sweeney Co., Pittsburg, $19,528; John D. Kuhn, Greensburg, $18,467; Drumheller & Roberts, Derry, $25,085; D. Dinardo, Pittsburg, $18,530. Contract awarded to LOGAN D. BURD.

IRWIN, PA.—WILLIAM WILLIAMS, of this place, has been awarded the contract for constructing an 8-in. sewer in Ninth and Spruce Sts.

MEADVILLE, PA.—Plans have been prepared by Hering & Fuller, 170 Broadway, New York, for the construction of a sewage disposal plant and collection system for the Fifth Ward. The plant will cost approximately $140,000, as follows: Collecting system for the Fifth Ward, $17,000; pumping station complete, $27,500; c.-i. pipe force mains, $10,000; septic tank, $14,000; sprinkling filter, $40,000; settling basin, $6,000; dosing basin, $3,000; grading roads, etc., $4,500, and land, right-of-way, etc., $18,300. The specifications call for a pumping station on Race St., in which will be installed two electrical centrifugal pumps of 350 gallons per min. capacity; a pumping station on Morris St., with two electrical centrifugal pumps with a capacity of 150 gallons per min.; a rearrangement of the present main pumping station, in which three electrical centrifugal pumps, each having a daily capacity of 2,250,000 gallons, will be installed; a sewage disposal plant having a septic tank with a daily capacity of 1,000,000 gallons; a sprinkling filter and a purification works built along standard lines. J. Homer Sporr is City Engr.

HARRISBURG, PA.—Bids will be received by the city until noon, Dec. 7, for the construction of a sewer in North St., from 15th St. to 90 ft. west of 16th St. W. W. Caldwell is Comr.

BALTIMORE, MD.—The Sewerage Commission on Nov. 20 approved specifications for the construction of additional storm-water drains. Estimated cost, $35,000. B. T. Fendall is City Engr.

WASHINGTON, D. C.—The WARREN E. BRENIZER CO., of Washington, has secured the contract for constructing sewers in Conduit Road, bids opened on Nov. 16, at the following prices: 7,500 cu. yds. excavation, 63 cts.; 65 cu. yds. sewer brick masonry, $14; 2,050 lin. ft. 24-in. terra cotta pipe sewer, $1.12; 1,250 lin. ft. 21-in., $1, and 1,750 18-in., 89 cts. Total, $10,738. Other bidders were: James A. Covle, $12,069; E. G. Gummel, $12,242; R. J. Beall Construction Co., $13,650; George Hyman, $14,378, all of Washington. Asa E. Phillips is Supt. of Sewers.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received by John T. Hume, Treas., Southern Branch, N. H. D. V. S., until Dec. 21, for rain water drain pipe, south side hospital building.

REIDSVILLE, N. C.—The city is considering the construction of a sewer system.

MARIETTA, GA.—The citizens on Nov. 16 voted to issue $30,000 of bonds for the construction of a sewerage system here.

*FITZGERALD, GA.—Bids are asked by the Water, Light and Bond Comn. until 3 p. m., Dec. 15, for the construction of a sewerage system including about 20 miles of vitrified pipe sewers from 6 to 18-in., manholes, etc. J. C. Anderson is City Engr.

JASPER, ALA.—The city contemplates the construction of a sewer system. Estimated cost, about $8,000. J. R. Smith is City Engr.

TUSKEGEE, ALA.—ISAAC C. MISHLER, Chattanooga, Tenn., was awarded the contract on Nov. 16 by the city at about $3,000 for constructing sanitary sewers and appurtenances. G. N. Mitcham is Engr.

LOUISVILLE, KY.—Bids will be received by the Commissioners of Sewerage until Dec. 11 for the construction of the 29th St. sewer, Contract 15; also until Dec. 18 for the construction of the Beargrass intercepter, Section D, Contract 16. J. B. F. Breed is Ch. Engr.; Harrison P. Eddy is Consulting Engr., 14 Beacon St., Boston, Mass.

FRANKLIN, KY.—Bids will be received until Dec. 7 for the construction of a sewerage system. Estimated cost, $20,000. C. E. Biggs is City Clk.

ASHTABULA, OHIO.—Plans have been ordered prepared by the City Council for the construction of a storm water sewer in Parsons, Spencer and Lake Sts., a distance of ¾ mile. L. A. Amsden is City Engr.

DAYTON, OHIO.—Bids will be received until Dec. 4 by the Board of Public Service, W. A. Budroe, Clk., for furnishing material and constructing storm water sewers in portions of Wyoming St., requiring 1,535 lin. ft. of 36-in. concrete sewer, 6-in. ring faced invert, and 980 lin. ft. 24 and 12-in. vitrified pipe sewer.

The lowest bid opened on Nov. 20 by the Board of Public Service for the construction of a sewer in Caldwell St. was submitted by Paul & Kershner, Dayton, at $5,086.

CAMBRIDGE, OHIO.—Bids are asked by Sarah Rainey, Secy. Bd. Pub. Ser., until noon, Dec. 3, for the construction of sanitary sewers in portions of Highland and Wall Aves. O. M. Hoge is City Engr.

MOUNT VERNON, OHIO.—Bids are asked by the Ohio State Sanitorium Commission, Dr. C. O. Probst, Secy., State House, Columbus, until noon, Dec. 22, for the completion of the sewerage system and sewage disposal plant at the Ohio State Sanitarium near here.

HAMILTON, OHIO.—Bids are asked by the Board of Public Service until noon, Dec. 9, for the construction of storm water sewers. Christian Pabst is Secy. Bd.

KOKOMO, IND.—Bids will soon be asked for the construction of 40,000 ft. of 8 to 10-in. reinforced-concrete sewer. W. F. Mann is City Engr.

MILLER, IND.—A. P. Melton, City Engr., has been instructed to prepare plans for the construction of a sewerage system.

DETROIT, MICH.—The contract for constructing a portion of Section 4, Waterman Ave. sewer, bids opened Nov. 17, has been awarded by the Board of Public Works to LANGLEY & JEYNES, of Detroit, at $11,925. W. W. Magee is Secy. Bd.

SPRINGFIELD, ILL.—The Board of Local Improvements has awarded the contract for laying the 12-in. sewer in Edwards St., from 17th to 18th Sts., and in Mason St., from Rutledge to First Sts., to RICHARD EGAN at 46 cts. per lin. ft. for the sewer, $25 for manholes on Edwards St. and 76 cts. per lin. ft. for the sewer and 39 cts. per ft. for inlet pipe.

PIPESTONE, MINN.—Bids are asked by the Common Council until 8 p. m., Dec. 28, for the construction of a sewer and appurtenances, requiring 57 lin. ft. of 10-in. sewer under 6 ft. deep; 70 lin. ft. of 10-in. sewer, 6 to 8 ft. deep; 2,610 lin. ft. of 10-in. sewer, 8 to 10 ft. deep; six straight manholes; one junction manhole. S. W. Funk is City Recdr.

ST. PAUL, MINN.—Plans are being prepared by L. W. Rundlett, City Engr., for the construction of the proposed Portland-Aldine and the Prior Ave. sewer systems. Estimated cost, about $75,000 and $35,000, respectively. Both will be constructed during 1909, following the issuance of bonds by the city.

INDEPENDENCE, KAN.—Bids will be received by J. D. Kramer, City Clk., until 5 p. m., Dec. 15, for the construction of a main sewer.

WELLINGTON, KAN.—The contract for constructing sewers in District No. 3 has been awarded to E. M. ELY, of Wellington, at $18,400. A. B. Cheever is City Clk.

LINCOLN, NEB.—The contract for rebuilding the N St. storm sewer has been let to ABEL & ROBERTS for $12,895. Other bidders were: J. W. Turner, $14,953; M. Ford, $13,444. William Grant is City Engr.

REDFIELD, S. DAK.—Bids will be received by H. T. Patsch, City Audr., until 8 p. m., Dec. 14, for the construction of the main sewer of the city sanitary sewer system, from intersection of Humboldt Ave. and Holmes St. to their terminus.

NEWPORT, ARK.—We are officially advised that the contract for the construction of a sewer here will not be let until next spring. Estimated cost, $40,000. Lund & Hill are Consult. Engrs., Little Rock, Ark.

MOUNT VERNON, WASH.—We are officially advised that bids were received as follows on Nov. 4 by the city for the construction of a sewer system in various streets: Wells & McCue, Bellingham, Wash., $14,493; Burrell Bridge & Construction Co., Seattle, Wash., $15,939; William Virlan & Co., Sedro Woolley, $18,529; International Contract Co., Seattle, $18,274; Dunn & Dunn, Seattle, $16,634; Riddle, Kavenaugh & Hawkins, Bellingham, $16,173; J M Ager, Bellingham, $18,752; Arthur I. Bent, Bellingham, $19,803; Chas. E. Lind, Bellingham, $13,903. J. S. Bowen is City Clk.

LOS ANGELES, CAL.—Bids will be received by C. G. Keyes, Clk. Bd. of Supervisors of Los Angeles County, until 2 p. m., Dec. 7, for the construction of a storm drain, catch basins, manholes and combination cement gutter and curb on Ocean Ave. and Adelaide Drive, partly in the City of Santa Monica and partly in the Santa Monica Road District.

MONTREAL, QUE.—The Road Department will construct sewers on College St. and Third Ave. J. R. Barlow is City Surv.

WINNIPEG, MAN.—DOBSON & JACKSON, 374 Colony St., Winnipeg, have secured the contract for constructing a sewer in Levis St., from Chalmers to Stadacona Sts., at $12,185.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

HARTFORD, CONN.—Contracts for the construction of state road work, bids for which were opened on Nov. 18, have been awarded as follows: Town of Orange, 17,550 lin. ft. macadam-telford with retaining wall and four 12-in., one 18-in., one 15-in., and five 24-in. tile culverts, to C. W. BLAKESLEE & SONS, New Haven, Conn., at $1.40½ per lin. ft. for macadam, $1.76 for telford, and $5.50 per cu. yd. for wall. Other bidders were: Connecticut Contracting Co., Hartford, $2.90, $3.28, $4.25; The B. D. Pierce, Jr., Co., Bridgeport, $2.08, $2.88, $5.75; Pierson Engineering & Construction Co., Bristol, $2.36, $2.95, $4.50; O. T. Benedict, Pittsfield, Mass., $2.25, $2.85, $6; Bennett N. Beard Co., Shelton, $2.60, $3.50, $5. Town of Woodbridge, 1,330 lin. ft. macadam on Seymour Road, to same, at $1.65 per lin. ft. Other bidders were: Frank Breault, New Haven, $2.25; E. N. Clarke, Milford, $2.44. City of New Haven, 1,930 lin. ft., macadam, 32 ft. wide on Orchard St., including Belgian block in certain restricted areas, to FRANK BRAZOS, New Haven, at 51 cts. per sq. yd. for macadam and 50 cts. per sq. yd. for blocks. Other bidders were: C. W. Blakeslee & Sons, New Haven, 53½ and 51 cts.; R. B. Davis, Hartford, 90 and 75 cts.

The contract for road work in Harwinton, bids for which were opened on Nov. 2, has been awarded as follows: 2,870 lin. ft. grading and telford road on Thomaston Road, to JOSEPH MASCETTI, at $4,290 and 35 cts. per lin. ft. for telford; 2,000 lin. ft. grading with railing on Center St., to JOSEPH MASCETTI, for $7,900 and 19 cts. per lin .ft. for railing. One 15-in., one 12-in. and one 18-in. tile culverts required.

The Board of Contract and Supply has awarded the contract for paving Church St. with asphalt to the SOUTHERN NEW ENGLAND PAVING CO., Hartford, at $1.67 per sq. ft. for asphalt and $6.35 per cu. yd. for concrete base. There were no other bidders.

HARTFORD, CONN.—Contracts for road work, bids for which were opened on Nov. 20, have been awarded as follows: Town of Berlin, 9,200 lin. ft. macadam, 2,000 lin. ft. telford, 4,000 lin. ft. railing, 75 cu. yds. masonry, including two 30-in., three 24-in., three 12-in., three 15-in., one 20-in., to O. T. BENEDICT, Pittsfield, Mass., at $1.89 for macadam, $2.49 for telford, 35 cts. for railing and $5.50 per cu. yd. for masonry. Other bidders were: A. Brazos & Sons, Middletown, $2.90, $3.50, 35 cts., $7; Lane Construction Corporation, Meriden, $2.09, $3.30, 35 cts., $6; A. Sternberg & Sons, West Hartford, $2.33, $2.90, 35 cts., $5; Pierson Engineering & Construction Co., Bristol, $2.91, $3.50, 25 cts., $5; Amos Bridge's Sons, Hazardville, $2.23, $2.83, 40 cts., $6; F. Arrigoni & Bro., Durham, $2.12, $2.70, 30 cts., $4.25; T. H. Gill Co., Winter Hill Station, Boston, Mass., $2.95, $3.50, 35 cts., $5.75; C. W. Blakeslee & Sons, New Haven, $2.39, $2.84, 40 cts., $5.50. Town of Middlefield, 1,525 lin. ft. macadam and 1,000 lin. ft. telford on Baileyville Road, including four 15-in., and one 24-in. tile culverts, to F. ARRIGONI & BRO., Durham, at $1.45 for macadam and $1.90 for telford. Other bidders were: O. T. Benedict, Pittsfield, Mass., $1.65 and $2.25; A. Brazos & Sons, Middletown, $2.34 and $2.90. Also 2,130 lin. ft. macadam and 1,240 lin. ft. telford, including one 15-in. and one 12-in. tile culverts, on Durham Turnpike, to same, at $1.45 and $1.90. Other bidders were: O. T. Benedict, $1.60 and $2.20; A. Brazos & Sons, $2.40 and $2.80. Town of Monroe, 3,200 lin. ft. grading on Newtown Turnpike, including one 18-in. and two 12-in. tile culverts, to M. L. TRAIL, Groton, at $2,500. Other bidders were: B. N. Beard Co., Shelton, $3,800; Trumbull & Fabbri, Litchfield, $4,700; T. H. Gill Co., Boston, $3,800. Bids were also received as follows, but contract not let, for 2,500 lin. ft. grading and 2,200 lin. ft. railing on the Shelton Hill Road: B. N. Beard Co., $4,000 and 17 cts. for railing; Trumbull & Fabbri, $7,100 and 25 cts; M. L. Trail, $4,955 and 35 cts.; T. H. Gill Co., $5,536 and 30 cts.

NEW BRIGHTON (S. I.), N. Y.—Bids are asked by George Cromwell, Pres. Boro. of Richmond, until noon, Dec. 8, for constructing cement sidewalks between Nos. 1954 and 1974 Richmond Terrace, Port Richmond, together with all work incidental thereto.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Dec. 10, by the Park Board for furnishing all the labor and materials for reconstructing and surfacing with asphaltic concrete that portion of Riverdale Ave. between the northerly and southerly boundaries of Spuyten Duyvil Parkway, Borough of the Bronx; for excavating and disposing of earth or other materials, and furnishing in place thereof good garden mold in the parks on Broadway, between 87th and 110th Sts., Borough of Manhattan; for furnishing and setting curbstones and for constructing walks of rock asphalt mastic in the addition to Riverside Park at 122d St., Borough of Manhattan; for excavating and disposing of earth and rock from the new walk entrance to Central Park at Central Park West and 106th St., Borough of Manhattan; for regulating and grading in the northerly half of John Jay Park, Borough of Manhattan. Henry Smith is Pres. Bd.

BROOKLYN, N. Y.—Bids were received on Nov. 25 by Bird S. Coler, Boro. Pres., for regulating, paving and repaving with asphalt on a concrete foundation the roadway of Elmore Place (East 22d St.), from Farragut Road to Avenue G, together with all work incidental thereto: Brooklyn Alcatraz Asphalt Paving Co., 407 Hamilton Ave., Brooklyn, $5,682; Cranford Co., 52 Ninth St., Brooklyn, $6,575; Standard Asphalt & Rubber Co., 115 Broadway, New York, $5,795; Uvalde Asphalt Paving Co., 1 Broadway, New York, $5,126; Barber Asphalt Paving Co., 30 Church St., New York, $6,055.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Dec. 16, by Bird S. Coler, Boro. Pres., for regulating, grading, paving and repairing with asphalt and granite on a concrete foundation the roadways of various streets; also for curbing and laying sidewalks and crosswalks.

DANSVILLE, N. Y.—The contract for constructing a section of state road to extend from this village to Rock Glen Brook, 5½ miles, has been awarded to the GREEN CONSTRUCTION CO., Rochester, by F. K. Skene, State Engr.

TROY, N. Y.—The following bids were opened on Nov. 6 by the Board of Contract and Supply for paving a portion of Second St.: North Hudson Valley Construction Co., Times Bldg., bitulithic $3.25 per sq. yd., asphalt block $3.50, brick $2.53, granite block $3.30, sheet asphalt $2.70; August J. Langefeld, granite block $3.15; Hassam Paving Co., $3. Estimated cost, $12,000.

The Board of Contract and Supply opened bids as follows on Nov. 10 for paving a portion of Congress St.—(a) 3,900 sq. yds. and (b) 2,650 sq. yds.: John H. Gleason & Co., brick, (a) $2.53 per sq. yd., (b) $2.70; sheet asphalt, (a) $2.70, (b) $2.90; granite block, (a) $2.84, (b) $2.95. A. J. Langefeld, granite block, (a) $3.00, (b) $3.05. Hassam Paving Co., 15 William St., New York, (a) $3.10, (b) $3.20. Estimated cost, $20,000.

TRENTON, N. J.—The DELAWARE RIVER QUARRY & CONSTRUCTION CO. has been awarded the contract for macadamizing a portion of Liberty St. Abram Swan is City Engr.

JERSEY CITY, N. J.—We are officially advised that JAMES MANNIX, 25 Gilchrist St., Jersey City, has been awarded the contract by the Street and Water Board for paving Cartaret Ave., 2,150 sq. yds., with Belgian block. Bids were opened on Nov. 15. George T. Bouton is Clk. Bd.

SALEM, N. J.—Bids are asked until 10:30 a. m., Dec. 9, by John F. Ayars, County Road Dir., for grading and placing gravel surface on 3.31 miles of road. Howard B. Keasbey is Engr., Mecum Bldg., Salem.

ATLANTIC CITY, N. J.—The City Council on Nov. 23 awarded the contract for paving on Tennessee and Ocean Aves. to the UNITED PAVING CO., at $13,500. The only other bidder was W. Gaudiosi, at $14,407.

WILKES-BARRE, PA.—The LEHIGH & WILKES-BARRE COAL & IRON CO. has been awarded the contract for macadamizing the mountain road at $16,013. Other bidders were: Kingston Construction Co., $11,050; Edward H. Post, $12,837; United Construction Co., $14,480.

WEST CHESTER, PA.—Bids were opened Nov. 10 by the Valley Forge Commission at the office of J. O. Clarke, Engr., 906 Crozer Bldg., Philadelphia, for grading and necessary work, including demolishing buildings grading, telford road, drains, walls, pave gutters, etc., along Valley Creek. The contract has been awarded to THOMAS MEEHAN & SONS, INC., of Mt. Airy, Philadelphia, at about $7,000.

CARRICK, PA.—Bids are asked by the Borough Council until 8 p. m., Dec. 7, for grading, curbing and paving Clifton Boulevard from Brownsville Road to Flower Ave. William McClurg Donley is Boro. Engr.

UNIONTOWN, PA.—We are officially advised that George J. Vetter, Meadville, Pa., was the lowest bidder on Nov. 25 for constructing 26,100 ft. of road in Menallen Township.

The Duster Contracting Co., Tarentum, Pa., submitted the lowest bid to the State Highway Department for 6,654 ft. of road in South Union Township. J. O. Neal is Ch. Clk., Dept.

BALTIMORE, MD.—The Board of Estimates has approved ordinances for the opening of Belt St., between Fort Ave. and Clement St., and Glover and Rose Sts.

The City will expend about $210,360 for paving improvements during the next year, including $35,000 for paving North Ave., between Gay and Washington Sts., now being undertaken; $14,410.20 for Wolfe St., from Monument to Jefferson Sts.; $12,330 for Eager St., from Homewood Ave. to Ensor St.; $12,027 for Valley St., from Chase to Ashland Aves.; $18,717 for Chester St., from Orleans to Baltimore Sts.; $21,875 for Ostend St., from Race to Leadenhall Sts.; $17,290 for Fremont Ave., from Baltimore to Lexington Sts. James H. Smith is Pres. Comrs. for Opening Sts.

ALEXANDRIA, VA.—The city has appropriated $6,000 for street and sewer construction.

WESTON, W. VA.—JOSEPH FUCCY, of this city, has been awarded the contract for the construction of a 16-ft. brick road, at $5,250.

GADSDEN, ALA.—The contract for paving a number of residence streets here, about 11,000 sq. yds., was awarded on Nov. 19 by the city to J. S. McLAUGHLIN & SONS, of Red Oak, Iowa, at 79½ cts. per sq. yd.

UNION SPRINGS, ALA.—The Commissioners of Bullock County have voted $100,000 of bonds for road improvements.

NEW ORLEANS, LA.—The city will expend about $1,000,000 in street paving, plans and specifications for which have been approved by the City Council. Bitulithic, asphalt and granitoid concrete blocked pavement will be used. Carrollton Ave., from St. Charles Ave. to City Park Ave., distance of about three miles, will probably be paved at a cost of about $800,000, of which the city will pay $500,000 and property-owners $300,000. W. J. Hardee is City Engr.

HARRISBURG, PA.—The State Highway Department, Joseph W. Hunter, Comr., has awarded the contract for the construction of the Lower Mifflin road in Cumberland County to SAMUEL S. STOUFFER, of Sharpsburg, Md., at about $11,000 per mile. The road will be about 2¼ miles in length, and macadam for the entire length.

CASEY CREEK, KY.—The Casey Creek & Wilson's Creek Turnpike Road Co. has been incorporated with $5,000 capital stock by J. M. Wolford, A. F. Scott, W. T. Hendrickson and others.

SHAWNEE, OHIO.—We are officially advised that bids will soon be asked for eight miles of paving.

McCOMB, OHIO.—C. B. HALL & SON, of Findlay, have secured the contract for paving 4,000 yds. at about $8,000.

CANTON, OHIO.—P. H. Weber, City Engr., has estimated the cost of paving West Tuscarawas St. at $46,924 and West Lake St. at $16,380. The work will be commenced in the spring.

YOUNGSTOWN, OHIO.—The Board of Public Service has awarded the contract for paving High St. to KENNEDY BROS. at $18,850. The filler will be of asphalt. The work will not be started until next spring.

COAL GROVE, OHIO.—The Village Council has received bids for the paving of Main St. as follows: Petersburg Fire Brick Co., $17,450; Ironton Construction Co., $20,138; F. J. Horschel, $20,015.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Dec. 23, by the County Commissioners, William F. Black, Clk., for the improvement of Royalton Road from Bennet Road to a point 500 ft. west of A. Rimke's east line in Royalton Township.

BEDFORD, IND.—Bids are asked until 1 p. m., Dec. 8, by Walter G. Owens, County Audr., for constructing 10,450 ft. of gravel or macadamized roadway.

ELKHART, IND.—We are officially advised that the ANDREWS ASPHALT PAVING CO., Hamilton, Ohio, was awarded the contract on Nov. 25 by the city for paving South Main St. with asphalt, at $1.98. Total, $45,109. T. G. Wilkinson is City Clk.

NOBLESVILLE, IND.—Bids are asked by the Commissioners of Hamilton County until Dec. 15 for the construction of the following gravel roads: No. 65, White River Township, length 9,300 ft.; Nos. 72, 74, 75, 76 and 84 in Adams Township, 6,502, 4,066, 3,712, 4,020, and 4,588 ft. in length, respectively; Nos. 78, 90, in Noblesville Township, 9,731 and 5,133 ft. in length, respectively; No. 79, in Wayne Township, 13,267 ft. in length; Nos. 80, 81 and 86, in Jackson Township, 3,458, 4,909 and 2,099 ft. in length, respectively; No. 88, in Fall Creek Township, 9,250 ft. in length; No. 89, between Wayne and Fall Creek Townships, 15,570 ft. in length; No. 97, between Noblesville and Jackson Townships, 14,756 ft. in length; and No. 91, between Delaware and Fall Creek Townships, 10,900 ft. in length. N. W. Cowgill, County Audr.

WABASH, IND.—Bids are asked by Fremont M'Lees, City Clk., until 6 p. m., Dec. 14, for the completion of the work for the construction of cement sidewalks on both sides of Allen St., from Walnut to Market Sts.

JEFFERSONVILLE, IND.—Plans and specifications are being prepared for granitoid pavements, stone curbing and vitrified brick gutters and intersections on a portion of Sixth St. Victor W. Lyon is City Engr.

VINCENNES, IND.—The Board of Public Works has let the contract for the improvement of West Sycamore St., from Schley to the Terre Haute Road, with concrete sidewalks and stone curbing on both sides of the street, to FOULKES, FORBES & CO., at 10½ cts. for sidewalk and 42 cts. for curbing.

MILWAUKEE, WIS.—The County Commisioners on Nov. 10 authorized an expenditure of $30,000 for good roads and county parks.

ST. PAUL, MINN.—Bids are asked until Dec. 21 by E. G. Krahmer, County Audr., for the improvement of Bald Eagle Lake Ave. by macadamizing or graveling.

CHANUTE, KAN.—C. L. BESLER has secured the contract for macadamizing about 1¼ miles of turnpike leading from the East Bridge, at $5,872.

ARGENTINE, MO.—The KANSAS CITY BITULITHIC PAVING CO., of Kansas City, Mo., has secured the contract for paving Metropolitan Ave. at $50,000.

KANSAS CITY, MO.—Contracts for paving were awarded by the Board of Public Works on Nov. 6 as follows: Asphalt paving, to PARKER-WASHINGTON CO., 4500 Duncan Ave., St. Louis, Mo., about 20,246 sq. yds., at $1.90 to $2.25 per sq. yd.; CLEVELAND TRINIDAD PAVING CO., 9,844 sq. yds., $1.90 to $1.98 per sq. yd.; BARBER ASPHALT PAVING CO., New Nelson Bldg., Kansas City, 1,443 sq. yds., $2.31 per sq. yd.; WILLIAM HARTE, 2,246 sq. yds. creosoted block pavement, $2.49 per sq. yd.

JEFFERSON CITY, MO.—Bids are asked until 4 p. m., Dec. 7, by the City Clerk for grading, guttering, macadamizing, graveling and rolling Broadway, from Main to Water Sts. E. F. C. Harding is City Engr.

HOUSTON, TEX.—Bids are asked by John B. Ashe, County Audr., until noon, Dec. 15, for paving Richmond Road.

DALLAS, TEX.—The city has awarded the contract to the TEXAS BITULITHIC CO., Dallas, for paving North Texas St. at $1.87½ per sq. yd.

EL RENO, OKLA.—The city has awarded the contract to the CLEVELAND TRINIDAD PAVING CO., Cleveland, Ohio, for paving various residence streets with asphalt at $2.29 per sq. yd. or about $400,000.

EL RENO, OKLA.—The TRINIDAD PAVING CO., of Cleveland, Ohio, has secured the contract for about 145,000 sq. yds. of paving here, at about $400,000. B. W. Riley is Mayor.

PURCELL, OKLA.—Bids will be received until Dec. 12 by R. L. McWillie, City Engr., for brick paving here.

SEATTLE, WASH.—The City Council has passed the following ordinances, providing for street improvements: North and West 70th St., concrete sidewalks, $4,605; Harrison St., planking, $7,300; 14th Ave., concrete sidewalks, $3,050; Fourth Ave., paving, $89,000; Sixth Ave., N. E., concrete walks, $13,200; 15th Ave., N. E., planking, $5,400; Pasadena Pl., concrete sidewalks, $3,550; 17th Ave., South, planking, $7,300. R. H. Thomson is City Engr.

SEATTLE, WASH.—The PACIFIC CONTRACTING & INVESTMENT CO. has been awarded the contract by the Government for clearing and grad[illegible] government buildings o[illegible] site of the Pacific exposition grou[illegible] Alaska-Yukon-

FRESNO, CAL.—The [illegible] of City Trustees on Nov. 18 award[illegible] contract to GOTTFRIED PETERSON [illegible] per sq. ft. for paving the west [illegible] per sq. Kern St. to San Diego [illegible] G St., from

THE WORSWICK CO[illegible] tract at 14½ cts. per sq[illegible] the concrete walks on G St., from T[illegible] laying sidewalks on Fresno St.

SACRAMENTO, CAL.—[illegible] pervisors on Nov. 21 re[illegible] Board of Supervisors steam road rollers as[illegible] for two Rickard & McCone, $6,180; [illegible] Harron, $6,500; A. L. Young Ma[illegible] Livermore, J. I. Case Co., $5,550; [illegible] Co., $6,000; Co., (two bids), $6,350 and [illegible] Buckley

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

MANCHESTER, N. H.—[illegible] been announced that the Amoskeag [illegible] of which T. Jefferson Coolidge, Am[illegible] of Boston, is a director, will build [illegible] Boston.

BOSTON, MASS.—Eugen[illegible] Floss is interested in the construction [illegible] cotton mill in East Boston to cost $[illegible] according to the New York "Commercial." The mills, weave sheds and power station will cover 45 acres of land fronting on the Chelsea River. The land has been purchased. The plant will consist of 250,000 spindles and 7,500 looms.

FALL RIVER, MASS.—The American Linen Co. has had plans made for an addition to its plant of about 10,000 spindles and preparatory machinery sufficient to balance the addition. Work is to be begun at once. With this addition the company will operate about 111,300 spindles. The addition will cost between $150,000 and $200,000.

At a recent meeting of the stockholders of the Sagamore Mfg. Co. it was voted to authorize the Board to proceed with the construction of a mill, the structure to contain about 50,000 spindles. F. A. Foster is a Director.

HOLYOKE, MASS.—The Farr Alpaca Co. will proceed to rebuild the warp dye-house at the rear of the Jackson St. mill, on the land bought last spring from the Holyoke Water Power Co. The structure will be one story high, about 325 × 72 ft.

FALL RIVER, MASS.—At the special meeting of stockholders of the Sagamore Mfg. Co., the proposition to build a third mill and increase the capital stock was adopted. The capital will be increased from $900,000 to $1,200,000. The directors were authorized to have constructed an additional mill, with about 50,000 spindles, to manufacture goods substantially like those now made by the Sagamore. These are goods of print cloth yarn construction. With the addition the Sagamore will have 141,000 spindles.

CHELSEA, MASS.—We are officially advised that FRANK G. GILBRETH, 34 West 26th St., has secured the contract to rebuild the box-making plant of the Atwood-McManus Co., which was destroyed in the second Chelsea fire. The contract will involve the construction of a power plant with two chimneys, a receiving building 345 ft. long, located on the Eastern division of the Boston & Maine R. R., an office building, a stable 200 ft. long, a sawdust and kindling wood building, a 2-story factory building 350 × 200 ft., and a warehouse 375 × 68 ft. The buildings, which are to be of heavy mill construction, resting on reinforced concrete foundations, will be so laid out that the raw lumber is transported by conveyors 20 to 25 ft. wide through the various buildings to emerge in the form of finished boxes. The building site forms a right triangle with one side 800 ft. long and another 550 ft. long. Lockwood, Greene & Co., 93 Federal St., Boston, Mass., are Archs. and Engrs.

PAWTUCKET, R. I.—Two mills, to give employment to 800 people, are to be erected in Darlington by the Royal Weaving Co. The company has mills in Pawtucket and Central Falls.

WOONSOCKET, R. I.—Four acres of land have been purchased by the Woonsocket Spinning Co. and a factory will be erected.

THOMPSONVILLE, CONN.—The Hartford Carpet Co. will erect a building 110 × 270 ft., three stories high with basement, construction to be of brick, for the manufacture of Axminster carpets.

It is reported that the Upson-Marston Co. will erect a mill.

BRISTOL, CONN.—Dunbar Bros. will erect a brick addition to their plant on Union St., it is stated.

SPRINGFIELD, CONN.—Samuel M. Green, Arch., of Holyoke, Mass., is drawing plans for a factory to be erected in Cypress St. for the U. S. Envelope Co. The building will be built of brick and steel, 5 stories, fireproof, 265 × 109 ft., with an "L" 65 × 80 ft. The plans will be completed in about ten days. W. O. Day is Treas. of the company.

COXSACKIE, N. Y.—The Copper Roller-Bearing Trolley Wheel Co., of New York, is having plans prepared for a factory building to be erected here for the manufacture of its products.

DANSVILLE, N. Y.—Rauber & Fontaine have commenced work on a new planing mill, 60 × 80 ft., to replace the mill burned recently. New machinery will be installed, which will be operated by electric power.

The Blum Shoe Co. has let contract to A. J. WENDEIN for the erection of a 4-story brick addition to its shoe factory here and for the adding of another story to its present factory building.

ELMIRA, N. Y.—C. J. Hancock Lake and Fourth Sts., has had plans prepared for a 2-story and basement bakery which he will erect on Madison Ave., between Second and Third Sts.

BINGHAMTON, N. Y.—The Georgian Mfg. Co. has let contract to the A. E. STEPHENS CO., Security Mutual Bldg., for the construction of laundry building, storage building, pattern shop and coal, coke and sand sheds and for remodelling the buildings of the Barse-Demorest Stove Co.'s plant recently purchased, the total cost of the work being $[illegible]. Other improvements are to follow at an estimated cost of $300,000. S. O. & S. A. Lacey are Archs., Security Mutual Bldg.

COLLEGE POINT (Flushing post-office), N. Y.—John N. Rapp, 1 Madison Ave., New York, will erect on Eighth St., at the corner of Third Ave., College Point, from plans by C. A. Jackson, a 1-story brick factory, 77 × 254 ft., costing $5,000. A. C. Jackson, 55 West 33d St., New York, is Arch.

ROCHESTER, N. Y.—We are officially advised that the Adler Bros. & Co., clothing manufacturers, 92 St. Paul St., will erect a building, 202 × 275 ft. of 4-story factory reinforced concrete. Albert Kahn, 800 Trussed Concrete Bldg., Detroit, is preparing plans. There will be a main building and a boiler house. No contracts have been let. Bids will be received in about three weeks. A part of the equipment needed follows: Engine plant, boilers, etc.; fuel or air ventilating and heating system; vacuum cleaners; electric lights. Cost, between $250,000 and $300,000.

BUFFALO, N. Y.—A. Nowack & Son will build a 3-story brick, concrete and structural iron warehouse and office 45 × 98 ft., at Broadway, and the New York Central Belt Line; also a 2-story warehouse, 45 × 50 ft. adjoining, of brick and frame, in replacement of buildings destroyed by fire recently. The company will repair and rebuild a brick grain elevator partly burned. Total estimated cost, $22,000. W. H. Zawadski, 1123 Broadway, Buffalo, is Arch., and will receive bids.

The Schreiber Brewing Co., will erect a brick, concrete and structural steel bottling works, 42 × 90 ft. on Fillmore Ave., near Broadway, at a cost of $24,000. Also a new office building 30 × 42 ft. of brick, concrete and steel. Cost, $6,000. Plans are being prepared, and bids will be received by W. H. Zawadski, Arch., 1123 Broadway and Buffalo.

LANCASTER, N. Y.—The American Malleable Co. will add two wings, each about 200 ft. in length, of brick and steel to the main building of its plant here. A pattern shop is to be built at once, and later on an office building.

PHILADELPHIA, PA.—The car manufacturing plant of the J. G. Brill Co. was partly destroyed by fire last week, at a loss of $300,000. Work on reconstruction has been started. James Rawles is Pres.

CONNELLSVILLE, PA.—The Royal Brick Co. has been formed and incorporated under the laws of this state with a capital stock of $75,000. A plant for the manufacture of fire and other refractory brick will be built next spring in Bullskin Township, near this city. Those interested are F. M. Rickey, Jr., Pennsville, Pa.; C. C. Leclair, Uniontown, Pa.; Thomas Jones, Mount Pleasant, Pa.; and Ewing P. Richey, E. L. Sherrick and George Hatfield, all of Connellsville. The company has a tract of about 300 acres of fire clay.

BRADDOCK, PA.—The U. S. Steel Corporation has decided to erect a plant at Universal, near Braddock, on the Bessemer R. R. for the manufacture of forged car wheels. The plant will cost about $1,500,000. It will be operated in connection with the Shoen Steel Wheel Co. at McKees Rocks, Pa., recently purchased by the corporation.

MONONGAHELA, PA.—Plans for a $500,000 coking plant have been completed by the Pittsburg & Westmoreland Coal Co., Fulton Bldg., Pittsburg, and work will be started shortly after the first of the year. The plant will be built near the Acme mine, located about ten miles south of Monongahela. Although specifications call for 200 ovens to be built next summer, the company intends to make the Acme plant larger.

WEST MIDDLESEX, PA.—G. W. Bovee, W. N. Kemp and Walter Hamilton, all of this city, are forming a company that will engage in the manufacture of cement blocks, brick, porch piers, etc. A site has already been secured, and the mechanical equipment will be purchased at once.

WILMINGTON, DEL.—Regarding the report that the Street and Sewer Department has decided to grant the application of the Harlan & Hollingsworth Corporation to close Justison St., so that the corporation may construct extensions. The firm advises us that building operations have been deferred for the present. The plans call for shops to cost $350,000, and it is intended to manufacture steel railroad cars of all kinds. When they are in operation the company expects to give employment to 1,000 additional men. The firm also has planned improvements for the shipbuilding department, and it is stated that there will be 3,000 workingmen employed in the plant.

BALTIMORE, MD.—John Freund, Jr., Arch., 210 East Lexington St., advises us that bids have been received, but the contract is in abeyance for an addition to be built to the bakery plant of William Freihofer, at Howard and Stockholm Sts. The designs provide for a 2-story brick building fronting 40 ft., with a depth of 175 ft., of mill construction.

Samuel Rosenberg, Holliday and Hillen Sts., has awarded contract to GEORGE BUNNECKE & Sons, 305 St. Paul St., Baltimore, for addition to tannery. It will be of brick, 43 × 85 ft., steam heat, two electric elevators. Cost, about $10,000. Joseph Evans Sperry, Calvert Bldg., Baltimore, is Arch.

Gandy Belting Co.'s additional factory building will be 90 × 100 ft., of New England mill construction, with exhaust-steam heating plant, electric-lighting plant, electric elevators, belt-stretching and other machinery. Estimated cost of completed building, $50,000. McLAUGHLIN BROS., 915 Bolton St., Baltimore, are the contractors. The company's office is at 728 West Pratt St.

RADFORD, VA.—The Radford Pipe Works will erect an addition to its molding department, to be 50 × 125 ft. Cost, $50,000. The contract for steel work has been awarded to VIRGINIA BRIDGE & IRON CO., Roanoke, Va. Concrete foundation and other work is to be done by the company. An electric traveling crane will be installed in this department.

ECKINGTON, VA.—The Joseph Schlitz Brewing Co., of Milwaukee, Wis., Julius E. Albrecht, Local Agent, will erect a bottling plant at Eckington. Charles L. Lesser is Arch., 333 Grove St., Milwaukee. The plant will be 75 × 305 ft., two stories, brick and stone; cement is to be used in foundations, floors and other parts of building where heavy machinery will be install d. Cost of plant, $100,000. JAMES M. DUNN, of Milwaukee, has the contract.

ROANOKE, VA.—The Acme Match Co. is completing arrangements for establishing a match factory. The contract for erection of reinforced-concrete building has been awarded to C. W. HANCOCK & SON, Roanoke.

FAYETTEVILLE, N. C.—R. G. Harrison, of Fayetteville, N. C., is planning the establishment of a plant to manufacture knit goods. He is making investigations with a view to purchasing the necessary machinery and may possibly adopt electricity for the motive power.

STATESVILLE, N. C.—The Turner Mills Co., of Statesville, N. C., is reported to have arranged to complete its proposed mill near East Monbo, N. C. Its main building will be two stories, 80 × 300 ft., and probably will be equipped with 12,000 spindles and accompanying machinery to producce fine yarns. About $35,000 will be the cost of this building, and the textile machinery will cost about $125,000. A 200,000-gallon reservoir will be built to provide water for the mill and the mill village and contract for constructing the reservoir has been awarded to S. S. ORDWAY & SONS, of Winston-Salem, N. C. C. H. Lester, of Monbo, N. C., is Archt.-Engr.-in-Charge for the Turner Mills Co., of which W. D. Turner, of Statesville, N. C., is Pres.

HENDERSON, N. C.—The factory of the Carolina Bagging Co., of Henderson, is to be rebuilt. It was destroyed in November by fire, from which the company sustained a loss of about $30,000.

The Parham Bagging Co. of Henderson, N. C., is planning to rebuilt its mill for the manufacture of cotton bagging. This plant wa destroyed by fire some time ago, the loss being about $20,000.

LEXINGTON, N. C.—The owners of the Yadkin Knitting Mills, of Lexington, have decided to replace the plant which was burned some months ago. There were 40 machines in the mill. The capital stock is $21,000.

LEXINGTON, N. C.—A concern to build a mill for the manufacture of colored cotton cloth is to be organized at Lexington by C. A. Hunt, Jr. He intends to have a capital stock of $125,000 and to erect a factory to be equipped with 10,944 spindles eventually, but to start with 8,208 spindles and 250 looms. Electricity will be used if available, and if not, steam power will be installed. About 150 operatives will be employed. Construction will begin next spring.

MULBERRY, FLA.—The Prairie Pebble Phosphate Co., Joseph Hall, Savannah, Ga., Pres., is having plans prepared for a dry bin to replace burned structure, it is stated. The structure will have a capacity of 30,000 tons of rock daily; building to be fireproof and to cost about $25,000. C. C. Martin is Gen. Mgr., Savannah, Ga.

EUFAULA, ALA.—The recent purchasers of the Eufaula Cotton Mills, of Eufaula, Ala., are reported to be planning the purchase of additional machinery to the extent of $50,000. This plant has been operating an equipment of 12,500 spindles and 370 looms. Its product is sheeting.

HOLT, ALA.—Plans are being prepared for a pipe foundry to be erected at Holt, Ala., by the Central Iron & Coal Co., 37 Wall St., New York.

SHREVEPORT, LA.—It is reported that the Allen Mfg. Co., of Shreveport, La., will spend $10,000 on improvements at its plant soon.

BURRWOOD, LA.—Bids are asked by Lieut. Col. Lansing H. Beach, Corps Engrs., U. S. A., until 11 a. m., Dec. 21, for furnishing and installing ice machine, refrigerating and distilling plant, in machine shop building at Burrwood, La.

DODSON, LA.—The Dodson Canning & Mfg. Co., D. M. Pyburn, Pres., recently organized to establish a cannery, will erect and equip cannery with capacity of 10,000 to 15,000 cans daily. The company will erect a frame building 30 × 80 ft., of ordinary construction.

GOSHEN, IND.—The Goshen Novelty & Brush Co. will erect a 3-story brick building, 160 × 160 ft., doubling the capacity of present plans. Bids will be in order as soon as plans are completed.

JEFFERSONVILLE, IND.—Trustees of Southern Indiana Reformatory are receiving bids for lumber, structural iron and other material to be used in the erection of a foundry and other buildings in place of those recently destroyed by fire. W. H. Whitaker is Supt.

LINDEN, IND.—The American Milling Company will ask for bids soon for rebuilding the plant recently destroyed by fire. A. G. Winter is Gen. Mgr.

INDIANAPOLIS, IND.—The Indiapapolis Rubber Co. will receive bids for the erection of a 3-story brick factory building on Georgia St. George W. Bedell, Law Bldg., is Arch.

MILWAUKEE, WIS.—The Milwaukee Bridge Co. has secured a building permit to erect a $30,000 addition to its plant at 34th St. and Concordia Ave.

A $50,000 factory building will be erected at the corner of Maple and Hanover Sts. for the Harsh-Smith & Edmonds Shoe Co., now located at Fourth and Clybourn Sts.

DULUTH, MINN.—The Derry Mfg. Co., recently incorporated, may erect a plant in the winter. The plans of the incorporators contemplate an expenditure of $30,000. The incorporators are: Henry J. and Louis T. Derry, Montpelier, N. Dak., and Prosper Derry, T. A. Park and Joseph Ryan, of Duluth.

MINNEAPOLIS, MINN.—The Brighton Car Co., 3632 Rockwell St., Chicago, has purchased 18 acres near St. Louis Park, a Minneapolis suburb, and will erect a car building plant which, when in full operation, will employ 1,000 men. It is stated that the company has a contract to build cars for the Chicago, Milwaukee & St. Paul Ry. Co.

DULUTH, MINN.—George A. Hormel & Co., meat packers and commission dealers, 206 West Michigan St., have let the contract for a 4-story reinforced-concrete and brick building to JOHN W. HILLIARD, of Duluth. The building will cost about $25,000. The structure will be of reinforced concrete, with an enameled brick front, and will be a fine addition to the line of wholesale houses on the busy street. It will be 50 × 95 ft., with a 50-ft. frontage on Michigan St. The equipment of the building will be for cold storage purposes.

ST. LOUIS, MO.—We are officially advised that L. Pfeiffenberger & Sons, Archs., First National Bank Bldg., East St. Louis, Ill., is taking estimates for a 1-story factory building to be erected in St. Louis, Mo., at $4,000, for the Scotts Dyeing & Cleaning Co., 3829 Olive St.

ST. LOUIS, MO.—The Champion Shoe Machinery Co., J. B. Dobyne, Pres., 3332 Franklin Ave., will erect a brick factory building, 150 × 182 ft., ordinary fireproof construction, to cost $15,000, to manufacture shoe-repairing machinery and wax-thread sewing machines for hames.

A syndicate has been formed to construct an automobile factory at Brentwood, St. Louis County. The plant will cost approximately $500,000 and ten acres of land will be purchased for the site. B. C. Stevens, of Clayton, Mo., is interested.

LITTLE ROCK, ARK.—It is stated that the El Campo Rice Milling Co., of El Campo, Tex., is considering the question of establishing a rice mill here George Armistead is Vice-Pres.

TEMPLE, TEX.—The Gulf, Colorado & Santa Fe Ry. Co., F. G. Pettibone, Gen. Mgr., Galveston, Tex., contemplates erection of a depot and office building and construction of terminal yards at Temple, expending about $300,000. C. F. W. Felt, Galveston, Tex., is Ch. Engr.

TACOMA, WASH.—C. B. Pride, of Tomahawk, Wis., will build a paper mill in Tacoma, it is stated, at a cost of $600,000.

AMHERST, N. S.—At a loss of about $120,000, the car erecting works of Rhodes, Curry & Co., Amherst, was burned recently. The works will be rebuilt at once.

WESTON, ONT.—Bids will be received by Leonard Foulds, Arch., 43 Victoria St., Toronto, for erection of five factory buildings and an engine house here for the Consolidated Chemical Co.

THOROLD, ONT.—The Colonial Wood Products Co., recently incorporated, will build a plant here for the manufacture of wood pulp products. Henry B. Eshelman of the Pettebone-Cataract Paper Co., of Niagara Falls, is the Mgr. of the new company.

WELLAND, ONT.—A company, capitalized at $250,000 represented by R Jenkins, will build a plant here for the manufacture of tin plate. The buildings will be of brick and steel frame construction on a site with frontage on the Grand Trunk Ry.

ST. JOHN'S, NEWFOUNDLAND.—The American-Newfoundland Lumber Co. has been organized at Grand Rapids, Mich., with a capital of $800,000, of which $450,000 has been subscribed, to conduct a logging and lumbering business on the west shore of Newfoundland, where the company owns 265,000 acres of land. A paper and pulp mill, with a 300-ton daily capacity, will be erected there. The offices will be in Grand Rapids. Among the organizers are Carroll F. Sweet and H. D. Dyckhouse, of Grand Rapids, W. C. Grobheiser, of Sturgis, and W. W. Hanchett, B. D. Keppel and J. G. Van Putten, of Holland, Mich.

MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water Supply—Irrigation.

SEAWALL.—San Francisco, Cal.—The Seawall Commission has awarded contract to GRAY BROS. for the construction of Section 11 of the seawall.

*SEAWALL.—Fort Morgan, Ala.—Bids will be received by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, until 11 a. m., Dec. 24, for construction of seawall at Fort Morgan.

*POWDER HOISTS.—Washington, D. C.—Bids are asked until 11 a. m., Dec. 31, by Lieut.-Col. Frederic V. Abbot, Corps Engrs., U. S. A., for furnishing and delivering powder hoists.

BULKHEAD.—San Francisco, Cal.—The Harbor Board has let contract to the PACIFIC CONSTRUCTION CO. to build a concrete bulkhead on Section 12 of the seawall, at $10,000.

LUMBER.—Toronto, Ont.—Bids are asked by Joseph Oliver, Mayor and Chn. Bd. of Control, until noon, Dec. 8, for lumber for bridges and wharves for the year ending Dec. 31, 1909.

DAM.—Dayton, Ohio.—Bids will be received until Dec. 5 (readvertisement) by the Board of Public Service for constructing the Riverdale dam extension and the repair of the old dam. W. A. Budroe, Clk.

LEVEE.—Lewisville, Ark.—Bids will be received until Dec. 11 by the Board of Directors of the Red River Levee Dist. No. 1, in Lewisville, for about 70,000 cu. yds. of levee work. W. L. Connevey, Secy.

PIER.—San Francisco, Cal.—The Harbor Board has let contract to the HEALY-TIBBITTS CONSTRUCTION CO. for the construction of Pier 38 for $279,000. Work on the pier is to be commenced at once.

DITCH.—Sadorus, Ill.—Bids will be received until Dec. 5 by David Tracey, Comr. East Lake Fork Special Drainage Dist., for constructing an additional tile drainage ditch in Sub-district No. 7. S. J. Day, Engr., Bement, Ill.

LEVEE.—North Topeka, Kan.—Bids were received on Nov. 21 by the North Topeka Drainage Bd. for construction of levees. Contract was awarded to SAM DOLMON & SON, North Topeka. Estimated cost, $60,000. J. B. Billard, Pres.

*LOCK AND DAM.—Mobile, Ala.—Bids were received on Nov. 17 by Maj. H. Jervey, Corps Engrs., U. S. A., for building Dock and Dam No. 16 and lock tender's house, Black Warrior River, Ala. Details are given in this issue under Contract Prices.

CONDUIT.—Canajoharie, N. Y.—Bids were received on Nov. 23 for the construction of a vitrified multiple duct conduit in Church St., Canajoharie. Contract was awarded to F. W. SCHUYLER, Fort Plain, N. Y., at $2,722. Chas. E. Fenry, Canajoharie, is Engr.

DRAIN.—Sibley, Iowa.—Bids were received on Nov. 23 for constructing drain in Drainage District No. 8. Contract was awarded to WM. GRAVES and WM. IMHOFF, Melvin, Iowa, at $7,600. Walter Barber, Sibley, is Engr. V. A. Burley is County Audr.

BALLAST.—Fort Leavenworth, Kan.—Bids are asked until 11 a. m., Dec. 7, by Capt. William D. Davis, Q. M., for furnishing and delivering in good condition f. o. b. cars, freight prepaid, 1,200 cu. yds. ballast for U. S. railway terminals at Fort Leavenworth.

DRAINS.—Eldora, Iowa.—Bids are asked until Dec. 11 by the Board of Supervisors of Hardin and Franklin Counties, at the office of R. A. Vigars, Auditor of Hardin County, at Eldora, for constructing a ditch and tile drains in Franklin-Hardin Drainage Dist. No. 1.

CONDUIT, CABLE.—Fort Riley, Kan.—Bids were received by Capt. W. M. Whitman, Corps Engrs., U. S. A., on Nov. 25 for constructing approximately 750 ft. electric conduit and installation of cable ,etc. Lowest bidder was W. E. Sweezey, Junction City, Kan., at $2,075.

FIRE ALARM SYSTEM.—New York, N. Y.—Bids are asked until 10:30 a. m., Dec. 10, by Nicholas J. Hayes, Fire Comr., for furnishing all the labor and materials required for establishing, completing and equipping an extension of the underground fire alarm telegraph system.

FIRE ALARM.—New York, N. Y.—The following bid was received on Nov. 16 by Nicholas J. Hayes, Fire Comr., for furnishing and delivering 75 fire alarm boxes for the use in Boroughs of Brooklyn and Queens: Gamewell Fire Alarm Telegraph Co., 19 Barclay St., $9,375.

HOSE WAGONS.—New York, N. Y.—Bids were received as follows on Nov. 25 by Nicholas J. Hayes, Fire Comr., for furnishing three extra large size hose wagons: American La France Fire Engine Co., 149 Broadway, $6,291; Combination Ladder Co., 32 Park Place, City, $5,367.

CEMENT.—New York, N. Y.—Bids are asked until 10 a. m., Dec. 10, by the Board of Health, Dr. Thomas Darlington, Pres., for furnishing and delivering, as required, 1,200 bbls. of Portland cement to the Tuberculosis Sanatorium at Otisville, Orange County, New York, during the years 1908 and 1909.

FENCES, GATES.—Fort Sam Houston, Tex.—Bids will be received until Dec. 12 by L. J. G. Fleming, Constr. Q. M., U. S. A., Fort Sam Houston, for the construction of paddock fences, gates, picket lines and removal and rebuilding woven wire fences for new cavalry stables at this post.

BEACONS.—Mobile, Ala.—The following bids were received on Nov. 4 by the Light-House Engineer, Mobile, Ala., for eight lighted beacons to mark Tampa cut channel, Hillsboro Bay, Fla.: The Edwards Construction Co., Tampa, $9,548; George W. Brown, West Palm Beach, Fla., $20,000. These bids have been rejected as excessive.

DAM.—Clinton, N. C.—Bids are asked until Dec. 7 by the County, A. J. Johnson, Chn., at Clinton, for constructing a dam across Little Coharie River, about 500 yds. long, 3½ ft. high, at least 6 ins. above high-water mark when settled, 24 ft. in bed and 18 ft. at top and ditches not to be closer than 2 ft. on each side.

DOCK.—San Francisco, Cal.—Bids are asked by the Harbor Board until Dec. 10 for a dock to be constructed in the Central Basin, near Illinois St., and almost adjoining the Union Iron Works, on unimproved property. The new dock will have a surface area of 150,000 sq. ft., will rest on green piles protected with concrete, and cost about $104,000.

TOWING.—New York, N. Y.—One bid was received by Allen N. Spooner, Comr. of Docks, on Nov. 23 for furnishing all the labor and materials required for furnishing about 2,000 hours' towing service on the North and East Rivers. Contract No. 1160. The Flannery's Towing Line Co., 33 Coenties Slip, city, was lowest bidder, at $3.48 per hour.

ARMOR PLATE.—Washington, D. C.—The Secretary of the Navy, Washington, has awarded the contract for furnishing armor plate for the battleships Florida and Utah, to the extent of about 10,000 tons, to the BETHLEHEM STEEL CO., the CARNEGIE STEEL CO. and the MIDVALE STEEL CO., in approximately equal amounts. The total price to be paid is $3,970,308.

CONTRACT PRICES.

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

*SEWERS.—Hartwell, Ohio.—Bids were received as follows on Nov. 16 by the Village Council for furnishing the necessary labor and materials for the construction of sewers and for the construction of sewage disposal works here—(A) Emanuel I. Schneider, Ann Arbor, Mich.; (B) Evan Evans, 1226 Ida St., Marion, Ind.; (D) Hannon & Sieverling, Springfield, Ohio; (E) Bosler & Flynn, James Bldg., Chattanooga, Tenn.; (F) Pease, Buzatt Construction Co., 9 Bradford Bldg., Indianapolis, Ind.; (G) Walter S. Hollaender, 1320 Race St., Cincinnati; (H) C. T. McCracken & Co., 214 Schultz Bldg., Columbus, Cincinnati, Ohio; (C) F. M. Benner & Co., Ohio; (I) Thomas P. [illegible], Goodall Bldg., Cincinnati; (J) William [illegible], Loyd, 701 Reibold Bldg., Dayton; (K) T. [illegible] Backus Construction Co., Reibold Bldg.; Preston; The Riggs & Sherman Co., 613 [illegible], Toledo, Ohio. are Engrs.:

		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
	lin. ft. 4" soft tile—laid	$0.05	$0.05	$0.06	$0.10	$0.10	$0.12	$0.025	$0.17	$0.0[illegible]	$0.20	$0.12
	lin. ft. 6" soft tile—laid	.08	.07	.08	.15	.15	.16	.045	.22	.10	.22	.16
37,002	lin. ft. 8" vitrified sewer pipe—laid	.13	.165	.14	.14	.15	.16	.10	.13	.1[illegible]	.22	.20
3,630	lin. ft. 10" vitrified sewer pipe—laid	.22	.215	.17	.22	.20	.22	.15	.20	.2[illegible]	.22	.17
1,475	lin. ft. 12" vitrified sewer pipe—laid	.29	.265	.23	.27	.30	.26	.20	.27	.2[illegible]	.27	.17
1,750	lin. ft. 15" vitrified sewer pipe—laid	.40	.395	.30	.42	.40	.36	.30	.43	.3[illegible]	.27	.26
1,270	lin. ft. 18" vitrified sewer pipe—laid	.50	.53	.38	.58	.60	.44	.45	.56	.4[illegible]	.34	.30
22,628	lin. ft. excavation under 8'	.45	.35	.30	.32	.35	.31	.40	.29	.5[illegible]	.47	.30
13,360	lin. ft. excavation, 8' to 10'	.45	.45	.45	.50	.45	.48	.50	.35	.6[illegible]	.59	.30
3,200	lin. ft. excavation, 10' to 12'	.60	.80	.65	.80	.75	.59	.75	.48	.8[illegible]	.99	.40
2,899	lin. ft. excavation, 12' to 14'	.60	1.00	.90	1.05	1.00	.91	.90	.76	1.2[illegible]	.84	.50
2,360	lin. ft. excavation, 14' to 16'	1.00	1.40	1.35	1.50	1.30	1.32	1.50	1.25	1.5[illegible]	1.12	.50
710	lin. ft. excavation, 16' to 18'	1.75	2.00	2.00	1.80	1.70	1.75	2.20	1.70	2.2[illegible]	1.40	.50
15	lin. ft. excavation, 18' to 20'	2.50	2.50	2.50	2.50	3.00	2.75	3.00	3.00	3.0[illegible]	1.75	.50
15	lin. ft. excavation, 20' to 22'	2.50	3.00	3.50	3.50	3.85	3.00	4.00	3.75	3.2[illegible]	2.00	.50
30	lin. ft. excavation, 22' to 24'	2.50	4.00	5.00	4.75	4.60	5.00	5.00	4.00	3.5[illegible]	2.28	.50
	lin. ft. excavation, 24' to 26'	2.50	5.00	.....	6.00	6.00	6.50	6.00	5.00	4.0[illegible]	2.50	.50
14	flush tanks (each)	60.00	75.00	55.00	50.00	65.00	60.00	75.00	80.00	100.00	2.[illegible]	.50
106	manholes (each)	28.00	30.00	40.00	30.00	35.00	32.00	28.00	35.00	40.00	2.[illegible]	5.00
8	drop manholes (each)	38.00	50.00	45.00	40.00	45.00	60.00	60.00	65.00	50.00	2.[illegible]	5.00
1	interception manhole	75.00	50.00	60.00	40.00	45.00	50.00	50.00	100.00	60.00	2.[illegible]	5.00
1	18" sluice gate	90.00	150.00	100.00	85.00	100.00	100.00	150.00	150.00	75.00	2.[illegible]	10.00
	cast-iron pipe, per ton—laid	50.00	50.00	35.00	50.00	50.00	50.00	48.00	45.00	50.00	2.[illegible]	10.00
15	cu. yds. concrete	5.00	10.00	7.00	7.00	8.00	8.00	8.00	7.00	7.00	2.[illegible]	30.00
	Timber in foundation, per M. B. M	30.00	40.00	35.00	40.00	30.00	35.00	28.00	50.00	40.00	2.[illegible]	10.00
	Earth excavation, per cu. yd	.40	2.00	.50	1.00	1.00	3.75	2.00	4.50	3.00	2.[illegible]	25.00
	Rock excavation, per cu. yd	3.50	.01	4.00	4.50	4.50	1.00	.50	1.60	1.00	2.[illegible]	4.50
	Pump well—machinery and tanks (each)	12,751.00	4,300.00	5,000.00	3,700.00	4,700.00	17,480.00	17,000.00	16,500.00	12,000.00	2.[illegible]	2.00
	Filter beds and drainage (each)		6,290.00	9,750.00	11,390.00	11,400.00			5,000.00		2.[illegible]	10,000.00
	Total for sewer	$35,276.11	$37,848.30	$35,033.73	$36,654.64	$37,082.35	$35,738.44	$36,388.00	$32,290.42	$45,361.17	$[illegible]	$47,823.64
	Total for sewage disposal	12,751.00	10,650.00	14,750.00	15,090.00	16,100.00	17,480.00	17,000.00	21,500.00	12,000.00	2.[illegible]	15,000.00
	Grand total	$48,027.11	$48,498.30	$49,783.73	$51,744.64	$53,182.35	$53,218.44	$53,388.00	$53,790.42	$57,361.17	$[illegible]	$62,823.64

*BARGE CANAL.—Albany, N. Y.—The itemized prices of the bids received by F. C. Stevens, Supt. Public Works, on Nov. 18, for Barge Canal Contract No. 41, which is for building of embankments at Iroodequoit Creek crossing, were—(1) Engineer's estimate; (2) Scott Bros., Baldwinsville, N. Y.; (3) Whitmore, Rauber & Vicinus, Rochester, N. Y.; (4) Ryan & Hannington, 159 West 125th St., New York; (5) Miller Construction Co., Lockhaven, Pa.; (6) Acme Engineering & Contracting Co., Schenectady, N. Y.; (7) Morris Kantrowitz, Albany, N. Y.; (8) Sherman, Parker & Beebe, Utica, N. Y.; (9) Sundstrom & Stratton Co., 90 West St., New York; (10) William J. Oliver, Knoxville, Tenn.; (11) Booth & Flynn, Ltd., Pittsburg, Pa.; (12) Mason & Hanger Co. and Millard & Lupton Co., 50 Church St., New York; (13) Arthur McMullen, Park Row, New York; (14) Butler Bros.-Hoff Co., 1170 Broadway, New York; (15) Patterson & Co., Pittsburg, Pa.; (16) American Pipe Mfg. Co., 112 North Broad St., Philadelphia, Pa.; (17) Shanley-Morrissey, Inc., 527 Fifth Ave., New York; (18) Clement-King Co., 411 Land Title Bldg., Philadelphia; (19) M. A. Cleveland, Brockport, N. Y.; (20) Coast & Interior Contracting Co., Fayetteville, N. Y.:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Clearing (lump sum)	$250.00	$300.00	$250.00	$250.00	$250.00	$250.00	$250.00	$250.00	$300.00	$250.00
19,000 cu. yds. grubbing	.30	.35	.50	.30	.30	.30	.35	.36	.36	.30
1,072,000 cu. yds. excavation	.25	.22	.23	.23	.18	.255	.23	.23	.26	.195
865,000 cu. yds. forming embankment	.12	.105	.10	.12	.11	.115	.09	.10	.05	.12
320 cu. yds. second-class concrete	10.00	9.00	8.00	10.00	10.00	10.00	9.00	10.00	12.00	10.00
320 cu. yds. fourth-class riprap	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.60	3.00
1,800 sq. ft. expanded metal	.10	.10	.10	.10	.10	.10	.10	.10	.12	.10
For maintaining highway traffic (lump sum)	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00	1,650.00	1,500.00	1,800.00	1,500.00
Deduct price to be paid to the State of New York for buildings in place which are to be removed by the contractor without expense to the State, (lump sum)	400.00	400.00	800.00	400.00	500.00	400.00	350.00	400.00	400.00	400.00
Total	$383,190	$338,735	$347,210	$361,750	$299,400	$384,225	$336,530	$345,590	$335,718	$324,230

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Clearing (lump sum)	$250.00	$250.00	$250.00	$250.00	$250.00	$300.00	$250.00	$250.00	$250.00	$250.00
19,000 cu. yds. grubbing	.30	.30	.30	.30	.30	.36	.30	.30	.30	.30
1,072,000 cu. yds. excavation	.225	.21	.21	.22	.25	.27	.18	.23	.20	.2475
865,000 cu. yds. forming embankment	.12	.11	.12	.04	.1375	.06	.10	.12	.12	.12
320 cu. yds. second-class concrete	10.00	10.00	10.00	10.00	11.00	10.00	10.00	9.50	10.00	10.00
320 cu. yds. fourth-class riprap	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
1,800 sq. ft. expanded metal	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
For maintaining highway traffic (lump sum)	1,000.00	1,500.00	1,500.00	1,000.00	1,500.00	1,500.00	1,500.00	2,000.00	1,500.00	1,500.00
Deduct price to be paid to the State of New York for buildings in place which are to be removed by the contractor without expense to the State, (lump sum)	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00	400.00
Total	$355,890	$331,600	$334,310	$281,330	$398,647	$353,020	$290,850	$362,250	$329,590	$380,510

*DAM, BRIDGE WORK.—Chicago, Ill.—Bids in detail were received as follows on Nov. 18 by the Sanitary District of Chicago for building a reinforced-concrete dam, and for performing certain collateral bridge work. The bidders (all of Chicago) were: (A) American Engineering & Construction Co., 112 Clark St.; (B) George Donnersberger; (C) John W. Page; (D) James O. Heyworth, Railway Exchange Bldg.; (E) Great Lakes Dredge & Dock Co., Commerce Bldg.; (F) National Construction Co., Tacoma Bldg.; (G) Standard Construction Co., First National Bank Bldg.:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
210,000 cu. yds. excavation	$0.26¼	$0.28	$0.28	$0.29	$0.38¾	$0.40	$0.449
Temporary diversion bridge at Foster Ave. (lump sum)	856.00	1,160.00	1,000.00	800.00	1,000.00	1,000.00	1,500.00
Erection of metal work in the superstructures of bridges, 150 tons	20.20	28.00	22.00	18.00	15.00	20.00	12.00
31 M. ft. B. M. yellow pine lumber, per M. ft. B. M	58.75	47.00	55.00	45.00	55.00	65.00	47.00
23 M. ft. B. M. white oak lumber, per M. ft. B. M	53.75	54.00	60.00	55.00	65.00	50.00	54.00
1,900 lbs. iron or steel bolts and washers	.05	.05	.04	.06	.05	.04	.05
390 sq. yds. Shuman pavement	2.95	2.40	3.00	3.25	2.50	3.00	3.00
6,000 cu. ft. complete concrete cylinders	.45	.60	.75	.90	.48	.75	.80
4,000 lbs. water-tight metal linings	.07	.10	.10	.10	.12	.10	.10
350 cu. yds. No. 1 concrete	6.50	10.40	10.50	10.50	9.00	10.00	9.50
875 cu. yds. No. 2 concrete	6.12	5.70	10.00	9.00	8.50	9.00	7.50
70,600 lbs. reinforcing bars	.03	.05	.04	.03	.04	.03	.03
9.6 M. ft. B. M. Wakefield sheet piling, per M. ft	75.00	68.00	125.00	150.00	70.00	125.00	70.00
Total	$76,699	$85,165	$88,720	$89,277	$106,260	$111,950	$119,368

SEWER.—Seattle, Wash.—Bids were received on Nov. 14 by the Board of Public Works for construction of the middle section of the North Trunk sewer; the section extending from the Green Lake section to a point near Ross. Itemized bids were as follows—(A) Burrell Bridge & Construction Co., Seattle; (B) Twohy Bros., Seattle; (C) Puget Sound Bridge & Dredging Co., 95 Yesler Way, Seattle; (D) Rich-Harris Construction Co., Bailey Bldg., Seattle; (E) Krogh & Jessen, Seattle; R. H. Thomson is City Engr.:

	(A)	(B)	(C)	(D)	(E)
Fixed estimate	$10,000.00	$10,000.00	$10,000.00	$10,000.00	$10,000.00
4,856 lin. ft. 108" Sec. "B" sewer	45.00	43.50	57.50	35.00	43.85
8,333 lin. ft. 108" Sec. "A" sewer	45.00	45.50	57.50	34.45	44.10
1,530 lin. ft. 108" Sec. "C" sewer	45.00	73.75	57.50	37.25	45.35
35 manholes	90.00	60.00	90.00	90.00	80.00
370 lin. ft. manholes, extra depth	7.00	4.00	10.00	10.00	8.00
1 sand catcher	2,000.00	7,400.00	7,150.00	4,400.00	4,500.00
247 lin. ft. 30" brick sewer	9.00	7.00	9.00	10.00	18.00
330 lin. ft. 24" pipe sewer	5.00	4.40	5.00	7.00	5.00
18 lin. ft. 18" pipe sewer	3.00	3.00	3.50	3.00	3.00
47 lin. ft. 12" pipe sewer	2.00	2.50	1.80	2.00	2.00
47 lin. ft. 8" pipe sewer	1.00	2.00	1.40	2.00	1.50
2 manholes	90.00	75.00	145.00	75.00	100.00
1 manhole to be reconstructed	150.00	150.00	14.00	50.00	75.00
1 junction manhole	100.00	125.00	145.00	250.00	200.00
75 lin. ft. overflow box	2.00	5.50	12.00	2.00	15.00
1 emergency outlet	50.00	1,200.00	990.00	1,000.00	900.00
1 pair emergency outlet gates	100.00	500.00	1,200.00	1,000.00	500.00
200 lin. ft. 6" side connections	1.00	.50	1.40	2.00	.50
200 cu. yds. extra concrete 1:12	11.00	9.00	12.00	8.00	11.00
1,200 cu. yds. extra concrete 1:8	10.00	11.00	15.00	9.00	12.00
10,000 lbs. extra steel	.08	.08	.05	.08	.08
Total	$700,593	$746,089	$899,296	$556,496	$696,887

MISCELLANEOUS CONTRACTS.

(Continued from page 199.)

CRUISER.—Ottawa, Ont.—Bids are asked until noon, Jan. 15, by J. J. Desbarats, Acting Deputy Minister of Marine and Fisheries, Ottawa, for the construction of a twin screw steel cruiser for Fisheries Protection Service in British Columbia waters, of the following leading dimensions, namely: length over all, 250 ft.; breadth of beam molded, 32 ft., and depth from top of keel to top of beams at side, 17 ft.; to be delivered at Victoria, B. C.

*DREDGING.—Galveston, Tex.—Bids were received by Capt. John C. Oakes, Corps Engrs., U. S. A., as follows on Nov. 14 for dredging in Buffalo Bayou, about 650,000 cu. yds: (a) price per cu. yd., (b) total: North American Dredging Co., Galveston, (a) 16.74 cts., (b) $108,810; John Anderson, Gulfport, Miss., (a) 16 cts., (b) $104,000; John Jacobson, Texas City, Tex., (a) 13.45 cts., (b) $87,425; Bowers Southern Dredging Co., Galveston, (a) 19.8 cts., (b) $128,700.

*DREDGE.—Mobile, Ala.—Bids were received as follows on Nov. 20 at the office of Maj. H. Jervey, Corps Engrs, U. S. A., for constructing a steel hull 20-in. pump dredge for improving harbors on coast of Mississippi as follows: Springfield Boiler & Mfg. Co., Springfield, Ill., $177,000 (14 months); Atlantic Equipment Co., New York, N. Y., $173,500 (12 months); also alternative proposal of $149,750; Elliott Machine Co., Baltimore, Md., $144,000 (9 months) (recommended for acceptance).

GRAND STAND.—Carthage, Ohio.—Bids are asked until noon, Dec. 19, by D. L. Sampson, Secy. Bd. Dirs. of the Hamilton County Agricultural Society, Cincinnati, Ohio, for furnishing the necessary labor and material for the erection of a grand stand and alteration and additions to the present grand stand, located on the fair grounds at Carthage, Hamilton County, Ohio, according to plans and specifications prepared by Andrew R. James, Arch., Blymer Bldg., 574 Main St., Cincinnati, Ohio.

NAVAL SUPPLIES.—New York, N. Y.—Bids are asked until 10 a. m., Dec. 8, by E. B. Rogers, Paymaster-General, Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the navy yard, New York, N. Y., etc., a quantity of naval supplies, as follows: Sch. 588, steel; Sch. 618, construction of roadway; Sch. 629, locomotive, road roller, rails, frogs, etc.; Sch. 634, tap bolts, flax canvas, butchers' cleavers, china ware, glassware, candles; Sch. 636, hardware and tools; Sch. 637, brass, copper, tubing; Sch. 638, gold leaf, pipe, packing, valves; Sch. 640, carbon paper.

DITCH.—Burlington, Iowa.—Bids are asked until 2 p. m., Dec. 15, by the Joint Board of Supervisors of Louisa County and Des Moines County, acting for and on behalf of the Louisa-Des Moines Drainage District No. 4 of said counties, at the office of the Auditor of Des Moines County, Burlington, for the drainage system as follows, viz.: A vitrified sewer tile drain from Gates Lake to Iowa Slough—2,200 lin. ft. of 36-in. drain with concrete abutment and screen at the inlet in Gates Lake and concrete abutments and valve at the outlet into Iowa Slough, also four wye branch connections.

BARGE CANAL.—Albany, N. Y.—The State Canal Board has approved the plans and specifications presented by Frederick Skene, State Engr., for Barge Canal Contracts Nos. 36 and 38. Contract No. 36 is for providing winches for movable dams; 10 winches for proposed movable dams in the Mohawk River, and two winches for similar dams in the Genesee River. Contract No. 38 is for constructing the superstructure, substructure and approaches for a highway bridge at Wappings, about two miles west of Fairport, Monroe County. Bids will be asked on this work shortly by F. C. Stevens, Supt. Public Works.

FENCE, ETC.—New York, N. Y.—Bids were received as follows by the Bellevue and Allied Hospitals Department on Nov. 20, for furnishing and setting wrought iron fence, granite fence posts and copings, sidewalk curbs, sidewalk paving and other work in connection therewith in front of Pavilion A and the Pathological Department and Male Dormitory buildings of the New Bellevue Hospital, situated on First Ave. and bounded by 26th and 29th Sts.: William Horne Co., 71 West 132d St., $15,900; J. H. Parker Co., Ft. of East 26th St., $17,050; Bart Dunn, 444 East 66th St., $17,000; Kelly & Kelley, 45 East 42d St., $16,491; Thomas Cockerill, 147 Columbus Ave., $17,300; T. McLeod, $20,500; Joseph Beneditto, $17,950.

AIR COMPRESSORS.—Washington, D. C.—Bids were received as follows on Nov. 21 by the Bureau of Yards and Docks, Navy Dept., for furnishing and installing one 5,000-cu. ft. air compressor and accessories at each of the navy yards, Boston, Mass., and Mare Island, Cal.: (1) price for two air compressors complete with all equipment and accessories; (2) work complete with bidder's modification of methods and details. Nordberg Mfg. Co., Milwaukee, Wis., (1) $58,260; (2) $50,000. Chicago Pneumatic Tool Co., Fish Bldg., Chicago, Ill., (1) $65,500. Providence Engineering Works, 321 South Main St., Providence, R. I., (1) $52,900. Ingersoll-Rand Co., 11 Broadway, New York, (1) $59,071. Laidlaw-Dunn-Gordon Co., 115 Broadway, New York, (1) $50,892.

MACHINERY.—Tompkinsville, N. Y.—Bids were received as follows on Nov. 10 by the Light-House Engineer, Tompkinsville, for furnishing and installing machinery in the new lamp shed of the light-house depot, Tompkinsville: (a) lathe group reduction; (b) electric lighting reduction: Hemphill Engineering Co., 1 Murray St., $10,880, (a) $800, (b) $1,2 recommended for acceptance; Chas. F. Brown, $13,894, (a) $920, (b) $1,100; Westinghouse, Church, Kerr Co., $12,372, (a) $1,375; Griscom-Spencer Co., $14,254, (a) $854, (b) $2,523; F. D. Smith & C. G. Hawker, $12,900, (a) $575, (b) $800; Watson Flagg Engineering Co., $15,408, (a) $780, (b) $950; Watson Flagg Engineering Co., $13,450, (a) $585, (b) $850; Lew Woods, 2357 Jerome Ave., New York, $13,0 (a) $750, (b) $580; Chas. J. Crowley, 1, $12,870, (a) $945, (b) $1,150; Chas. J. Crowley, No. 2, $12,275, (a) $945, (b) $1,1 Chas. J. Crowley, No. 3, $11,500, (a) (b) $1,150; Edwin Burborn, 71 Wall St., New York, $10,800, (a) $264, (b) $7

COAL AND ASH HANDLING APPARATUS.—Charleston, S. C.—Bids were received as follows on Nov 14 by William M. Smith Ch. of Bureau, Navy Dept., Washington, D. C., for installing a coal and ash handling plant at the central power station, Navy Yard: Penn Bridge Co., 312 Bond Bldg., Washington, D. C., (a) $19,574, (b) $7,950, (c) $25,956 and $21,988. Guarantee Construction Co., 140 Cedar St., New York, (b) $16,970 (250-ton capacity); (b) $19,590 (250-ton capacity); (b) $21,930 (350-ton capacity); (b) $21,930 (350-ton capacity). Conveying Machinery Co., 125 Liberty St., New York, (a) $19,934; (b) $5,800; alternate proposal, (c) $23,184, combined plant; (c) $24,748, combined plant; (c) $19,650, combined plant; (a) $18,116; (b) $5,780. G. & W. Mfg. Co., 26 Cortlandt St., New York, (a) $20,887; (b) $7,000; alternate proposition, (a) $20,453 if crusher of less massive construction. Geo. W. McCaslin, 2 Rector St., New York, (a) $17,539. Belmont Iron Works, 2215 Washington Ave., Philadelphia, Pa., (a) $20,895; (b) $7,990. Hyatt Engineering Co., 149 Broadway, New York. (b) $7,500. Link-Belt Co., (Nicetown), Philadelphia, Pa., (a) $16,215; (b) $8,195; (b) $4,000. Interstate Engineering Co., Bedford, Ohio, $(a) $14,420. Wm. J. Haskins, 36 Liberty St., New York, (a) $16,000. Exeter Machine Works, Pittston, Pa., (a) $22,000; (b) $7,975. C. O. Bartlett Snow Co., 1040 French St., Cleveland, Ohio, (a) $20,100; (b) $4,870; (b) $8,823, alternate.

DYKES.—Topeka, Kan.—The Board of the North Topeka Drainage District on Nov. 23 awarded the contract for building the dyke system for the protection of the north side from floods to SAMUEL DOLMAN & SON, of North Topeka, for $50,132. The time set for the completion of the dykes is April 1, 1909. The work is to start by Dec. 15. The following are the bids which were submitted: Griffith & Co., of Springfield, Ill., $64,601; J. Burke, of Kansas City, Mo., $51,824; Cameron, McManus & Joyce, of Keokuk, Iowa, $51,067, and Dolman & Son, of North Topeka, $50,132. The dykes will be riprapped and masonry work used in places where they are exposed to the currents of water. The dyke from Kansas Ave. to the Rock Island bridge will be 20 ft. wide on top and 6 ft. high. Along this stretch there will also be 30,400 ft. of concrete retaining wall with a foundation below low water mark. Through Kuehne's place to the Rock Island bridge there will be an 8-ft. concrete wall. From the Rock Island bridge to the high ground in the Palmer tract the dyke will be 20 ft. wide on top and 7 ft. high. From Kansas Ave. to the Santa Fe bridge, 24 ft. wide and 9 ft. high. From the Santa Fe bridge to the Three Bridges, 16 ft. wide and 7 ft. high, and from the Three Bridges through Garfield Park, 24 ft. wide and 7 ft. high. Near the boat landing in Garfield Park there will be a piece of riprapping. The dyke from Holman's addition to the Curtis cemetery will be 30 ft. wide and 9 ft. high. The slope on the outside will be 2½ ft. to one and on the inside 1½ ft. to one. In all the dykes there will be 258,610 cu. yds. of earth, 800 yds. of concrete in the two walls and 1,200 yds. of riprapping.

RIVER AND HARBOR IMPROVEMENTS.—Washington, D. C.—The Chief of Engineers, U. S. A., in his annual report recommends that the following appropriations be made for improvement of rivers and harbors for the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908: (Appropriations exceeding $50,000 only are given.)

Maine.—Breakwater from Mount Desert to Porcupine Island, Bar Harbor, $50,000; Kennebec River, $113,500.

Vermont.—Harbor at Burlington, $85,555.

Massachusetts.—Harbor of refuge, Sandy Bay, $575,000 (part of this amount is for continuing contract work authorized by the river and harbor act of March 2, 1907); Harbor at Provincetown, $135,000; Harbor of refuge, Nantucket, $80,000; Harbors at New Bedford and Fairhaven, $227,000.

Rhode Island.—Harbor of Newport, $53,800; Great Salt Pond, Block Island, $105,000.

Connecticut.—Breakwaters at New Haven, $200,000; Bridgeport Harbor, $110,000; Harbors at Fivemile River, Stamford, Southport, Greenwich and Westport and Saugatuck River, $63,311.

New York.—Block Rock Harbor and Channel, $1,000,000 (of this amount $1,000,000 is for continuing contract work); Harbor at Charlotte, $80,000; harbor at Oswego, $185,000 (of this amount $100,000 is for continuing contract work); harbor at Cape Vincent, $72,000; East River and Hell Gate, $300,000; Harlem River, $300,000; Hudson River, $470,000; New York Harbor (general improvement), $150,000; Ambrose Channel, $625,000 (of this amount $168,000 is under contract authorization of 1899 and $467,000 under that of 1907); Channel in Gowanus Bay—Bay Ridge and Red Hook channels, New York Harbor, $300,000; enlargement of Governor's Island, $75,000.

New Jersey.—Passaic River, $310,000; Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey—(a) Arthur Kill, $200,000, (b) channel between Staten Island and New Jersey, $220,000; Keyport Harbor, Matawan Creek, Raritan, South and Elizabeth Rivers, Shoal Harbor and Compton Creek and Cheesequake Creek, $158,095; Cold Spring Inlet, $265,000.

Pennsylvania.—Delaware River, New Jersey and Pennsylvania, $390,000 (of this amount $125,000 is for continuing contract work authorized by the river and harbor act of Mar. 2, 1907, and $265,000 for work of maintenance, including Philadelphia Harbor above Christian St.; Monongahela River (lock and dams), $243,000 (of this amount $200,000 is for continuing contract work on Lock No. 5); construction of locks and dams in Ohio River (40.5 miles), $75,000.

Delaware.—Appoquinimink, Murderkill and Mispillion River, $80,225; Wilmington Harbor, $237,000.

Maryland.—Patapsco River and channel to Baltimore, $965,000; Harbor of Southwest Baltimore (Spring Garden), $53,000; Harbors at Rockhall, Queenstown, Claiborne and Cambridge and Chester, Choptank, Warnick, Pocomoke, La Trappe and Manokin Rivers and Tyaskin Creek, $80,000.

Washington, D. C.—Potomac River at Washington, $125,000; Anacostia River, $150,000.

Virginia.—Rappahannock River, $62,000; James River, $400,000; York, Mattaponi and Pamunkey Rivers and Occoquan and Carter's Creek, $66,400; Harbor at Norfolk, 30-ft. channel, $100,000.

North Carolina.—Inland waterway from Pamlico Sound to Beaufort Inlet, $180,000; Cape Fear River at and below Wilmington, $500,000 (of this amount $100,000 is for continuing contract work authorized by the river and harbor act of Mar. 2, 1907.

South Carolina.—Santee, Wateree and Congaree Rivers, $60,000; inland waterways between Charleston Harbor and opposite McClellanville, $66,000.

Georgia.—Savannah Harbor, $400,000; Savannah River below Augusta, $54,000; Altamaha, Oconee and Ocmulgee Rivers, $88,000; Cumberland Sound, Georgia and Florida, $50,000; Chattahoochee River, Georgia and Alabama, below Columbus, $230,000.

Florida.—St. Johns River, $367,000; St. Johns River opposite Jacksonville, $215,000; St. Johns River at Orange Mills Flats, $65,000; Harbor at Key West and entrance thereto, $50,000; Withlacoochee River, $50,000; Apalachicola Bay, $80,000; East Pass and Carrabelle bar and harbor, $75,000; Harbor at Pensacola, $150,000.

Alabama.—Alabama River, $200,000; Coosa River, between Wetumpka and East Tennessee, Virginia & Georgia R. R. bridge, $100,000; Mobile Harbor, $492,000 (of this amount $200,000 is for continuing contract work); Mobile bar, $50,000; Tombigbee River, from mouth to Demopolis (construction of locks and dams), $1,000,000.

Mississippi.—Pascagoula River, $250,000; Harbor at Gulfport and Ship Island Pass, $200,000; Southwest Pass, Mississippi River, $330,000; Tchula River, $50,000.

Ohio.—Ohio River (general improvement), $545,000; Lock and Dam No. 37, Ohio River, $230,000; Cleveland Harbor, $775,000; Fairport Harbor, $250,000.

California.—Deep-water harbor at San Pedro Bay, $100,000; San Luis Obispo Harbor, $100,000; Oakland Harbor, $521,600; Stockton and Mormon channels, $56,679.

West Virginia.—Locks and dams in Ohio River between Pennsylvania State line and Cincinnati, $1,604,000; Big Sandy River and Levisa and Tug Forks, $78,000 (of this amount $50,000 is for continuing contract work, $25,000 for completing improvement at Dam No. 1, Levis Fork, and Dam No. 1, Tug Fork).

Kentucky.—Kentucky River, $450,000 (of this amount $210,000 is for continuing contract and $240,000 for completion of Lock and Dam No. 13).

Michigan.—Harbor of refuge at Grand Marais, $85,000; Manistique Harbor, $288,462; South Haven Harbor, $80,000; Grand Haven Harbor, $190,000; Muskegon Harbor, $154,750; White Lake and Pentwater harbors, $151,000; Ludington Harbor, $208,000; St. Marys River, at falls, $750,000; Hay Lake and Neehish channels, St. Marys River, $435,000; Saginaw River, $50,000; harbor of refuge at Harbor Beach, Lake Huron, $275,000; Detroit River, $2,750,000 (general improvement, $250,000; Livingstone channel, $2,500,000).

Wisconsin.—Kewaunee Harbor, $50,000; Fox River, $75,000.

Illinois.—Chicago Harbor, $54,960; tunnels under Chicago River, $300,000; Illinois River, $50,000.

Indiana.—Michigan City Harbor (outer harbor), $75,000.

Arkansas.—Red River, below Fulton, $75,000; Ouachita and Black Rivers (Ark. and La.), $510,135 (of this amount $176,135 is for continuing contract work, $294,000 for completing Lock and Dams Nos. 2 and 8, and $40,000 for work of maintenance).

Missouri.—Mississippi River, between Ohio and Missouri Rivers, $250,000; Missouri River, general improvement, $350,000; Osage River, $80,000.

Minnesota.—Mississippi River between Missouri River and Minneapolis, Minn., between Missouri River and St. Paul, Minn., $500,000; Mississippi River, between St. Paul and Minneapolis, $239,530; Harbor at Duluth and Superior, Wis., $797,000.

Tennessee.—Cumberland River, above Nashville (257 miles), $345,000 (of this amount $250,000 is for continuing contract work, $85,000 is for completing Lock No. 21 and $10,000 for maintenance); Tennessee River, above Chattanooga (188 miles), $110,000; Tennessee River, to Riverton Ala., Holes Bar Lock and Dam, $50,875; open-channel work, $210,000; Colbert and Bee Tree Shoals, $120,000; Tennessee River, below Riverton, Ala. (226 miles), $50,000.

Louisiana.—Bayou Plaquemine, Grand River and Pigeon Bayous, $50,000; widening waterway from Franklin to Mermentau, $100,000.

Texas.—Galveston Harbor, $270,000; Galveston Channel, $200,000; channel from Galveston Harbor to Texas City, $50,000; channel to Port Bolivar, $50,000; Galveston ship channel and Buffalo Bayou, $480,000; West Galveston Bay channel and mouths of adjacent streams, including Trinity River, Anahuac channel, Cedar Bayou, Chocolate Bayou and Bastrop Bayou, $100,000; inland waterway on coast of Texas, $155,000 (of this amount $55,000 is for continuing contract work); Aransas Pass, $230,000 (of this amount $80,000 is for continuing contract work; Harbor at Sabine Pass, $210,000 (of this amount $10,000 is for continuing contract work); Brazos River from Old Washington to Waco (for lock and dam at Hidalgo Falls), $50,000; Trinity River, $125,000.

Oregon.—Columbia River and tributaries above Celilo Falls to the mouth of the Snake River, Ore. and Wash., $75,000; Columbia River, between the foot of the Dalles Rapids and the head of Celilo Falls, Ore. and Wash., $1,164,000 (of this amount $164,000 is under continuing contract work); canal at the Cascades, Columbia River, $108,500; Columbia and Lower Willamette Rivers below Portland, $300,000; mouth of Columbia River, Ore. and Wash., $450,000.

Washington.—Grays Harbor and bar entrance, $100,000; Grays Harbor (inner portion), between Aberdeen and entrance of said harbor, and Chehalis River, $81,000; Puget Sound and its tributary water, $130,000.

Hawaii.—Pearl Harbor, $500,000; harbor at Hilo, $600,000 (of this amount $100,000 is for continuing contract work).

Porto Rico.—Harbor at San Juan, $380,000.

CONTRACT PRICES.

(Continued from page 200.)

WATER-PIPE.—Shawnee, Ohio.—Bids were received as follows on Nov. 5 by the city for furnishing and laying c.-i. water pipe, etc.: (A) Richards Plumbing Co., Columbus, Ohio; (B) U. S. Construction Co., Columbus; (C) Pittsburg Construction Co., Leasdale, Pa., Bradbury & Shute, Columbus, are Engrs.:

	(A)	(B)	(C)
9,433 ft. excavation..	$0.27½	$0.18	$0.25
2,682 ft. 4" pipe.....	.44	.38	.58
4,450 ft. 6" pipe.....	.61½	.54	.68
2,300 ft. 8" pipe.....	.81½	.75	.87
2.8 tons specials...	118.00	75.00	100.00
27 4" valves	15.05	12.50	12.00
9 6" valves	20.80	17.50	16.00
7 8" valves	29.20	22.00	20.00
22 hydrants	30.75	27.00	35.00
10 cu. yds. concrete	12.50	6.00	10.00
Total	$10,315	$8,358	$10,699

*LOCK AND DAM.—Mobile, Ala.—Bids were received on Nov. 17 by Maj. H. Jervey, Corps Engrs., U. S. A., for building Dock and Dam No. 16 and lock tender's house, Black Warrior River, Ala. Bids in detail were as follows: (A) H. H. Hardaway, Columbus, Ga.; (B) Robt. C. Storrie, Philadelphia; (C) the Dravo Contracting Co., Pittsburg:

	(A)	(B)	(C)
7 acres grubbing and clearing	$100.00	$200.00	$80.00
70,000 cu. yds. concrete excavation	.50	.75	.80
35,000 cu. yds. rock excavation	1.50	2.75	2.85
3,200 cu. yds. stone filling	2.50	2.00	2.35
38,810 cu. yds. concrete	7.50	7.50	6.50
6,000 cu. yds. riprap, hand placed	3.00	2.50	3.10
4,000 ft. B. M. miter sills	100.00	150.00	100.00
10,000 ft. B. M. framed timber, heart	75.00	60.00	70.00
365,000 ft. B. M. cofferdam timber	50.00	35.00	50.00
100,000 lbs. placing valves and special irons	.04	.05	.015
Total	$428,875	$481,000	$455,545
Lock tender's house	3,000	3,200	3,500
Grand total	$431,375	$484,800	$459,045
Alternative type of cofferdam	$12,500	$10,000	.....

*BORINGS.—New York, N. Y.—Bids were received as follows on Nov. 17 by the Board of Water Supply for making borings along one or more lines south of Hill View reservoir, lying mainly in the Boroughs of the Bronx, Manhattan and rBooklyn, including lines crossing the Harlem River, probably between Seventh Avenue and Washington Bridge, and the East River, approximately between the Williamsburg and Brooklyn bridges, the work being divided into sections. (A) SNARE & TRIEST CO., 143 Liberty St. (awarded contract); (B) Healey Sewer Construction Co., 21 Park Row, New York; (C) Geo. H. St. Clair, Virginia, Minn.; (D) Chas. H. Strong Son & Co., Cleveland, and Cyclone Drill Co., Orrville, Ohio; (E) The Phoenix Construction Co., 41 Park Row, New York; (F) The United Engineering & Contracting Co., 32 East 33d St., New York; (G) Sullivan Machinery Co., 42 Broadway, New York.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Land Borings.							
5,000 lin. ft. sinking casing for 1-in. cores	1.80	2.95	3.00	1.75	2.84	3.36	4.50
1,800 lin. ft. sinking casing for 1¾-in. cores	1.95	2.98	3.00	1.85	4.25	3.74	5.00
200 lin. ft. sinking casing for 3-in. cores	2.10	3.00	3.50	2.95	5.35	5.93	6.00
1,400 lin. ft. drilling 1-in. cores where rock penetration does not exceed 50 ft.	4.12	2.95	6.00	3.50	7.80	6.21	4.50
300 lin. ft. drilling 1-in. cores where rock penetration exceeds 50 ft.	3.75	2.95	6.00	4.00	6.80	7.61	4.50
9,400 lin. ft. drilling 1¾-in. cores where rock penetration exceeds 50 ft.	4.20	2.98	6.00	4.00	7.30	5.23	5.00
300 lin. ft. drilling 3-in. cores where rock penetration exceeds 50 ft.	4.90	3.00	8.00	6.00	9.10	8.80	6.00
20 days transporting drilling machines	30.00	15.00	14.50	30.00	45.00	50.00	20.00
200 hours pumping holes	4.50	2.00	1.00	4.00	6.00	5.00	5.00
River Borings.							
4,000 lin. ft. sinking casing for 1-in. cores	4.20	7.79	4.00	11.00	9.00	....	20.00
300 lin. ft. sinking casing for 1¾-in. cores	4.35	9.87	4.00	11.50	9.00	15.62	21.50
200 lin. ft. sinking casing for 3-in. cores	4.50	10.75	5.00	12.50	9.00	18.12	23.50
700 lin. ft. drilling 1-in. cores where rock penetration does not exceed 50 ft.	9.00	7.79	7.00	12.50	17.70	18.12	20.00
1,150 lin. ft. drilling 1-in. cores where rock penetration exceeds 50 ft.	9.10	7.79	7.00	14.50	13.20	22.60	20.00
300 lin. ft. drilling 1¾-in. cores where rock penetration exceeds 50 ft.	9.60	9.87	8.00	14.50	13.60	23.50	21.50
150 lin. ft. drilling 3-in. cores where rock penetration exceeds 50 ft.	9.90	10.75	9.00	16.50	16.05	29.30	23.50
General Items.							
300 lin. ft. 6-in. or larger casing left in place	3.00	.94	1.30	1.50	1.25	4.00	1.65
300 lin. ft. 4½-in. to 5½-in. casing left in place	2.00	.75	1.00	1.00	.65	1.75	1.35
500 lin. ft. 3-in. to 4-in. casing left in place	1.50	.53	.60	.75	.55	.90	.85
500 lin. ft. 2-in. to 2½-in. casing left in place	1.20	.40	.30	.60	.40	.50	.60
Totals	$105,678	$111,569	$126,657	$143,195	$184,932	$211,826	$230,300

Time: 5,800 lin. ft. of land borings within 6 months; expires by limitation Dec. 31, 1910.
Bond required: $50,000.
Engineer's estimate: $191,145.

U. S. POSSESSIONS AND CUBA.

TOWING MACHINES.—Panama.—Bids are asked until 10:30 a. m., Dec. 9, by the Isthmian Canal Commission, Washington, D. C., for furnishing twelve towing machines.

LUMBER AND PILES.—Panama.—Bids are asked until 2:30 p. m., Dec. 3, by the Isthmian Canal Commission, Washington, D. C., for lumber and piles, under Circular No. 481-B.

LOCOMOTIVES.—Panama.—Bids are asked by the Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., Dec. 7, for furnishing ten narrow-gage locomotives, under Circular No. 479.

LUMBER.—Panama.—The Isthmian Canal Commission, Washington, D. C., has awarded to W. R. GRACE & CO., 614 California St., San Francisco, contract for furnishing a quantity of Douglas fir lumber, at $13,474.

CRANES.—Panama.—The time for receiving bids for furnishing three rapid unloading cranes, according to Circular 475, has again been extended—from Nov. 24 to 10:30 a. m., Dec. 4. Capt. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C.

SUPPLIES.—Panama.—Bids will be received until 10:30 a. m., Dec. 14, by Capt. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing, according to Circular 481, the following: Boilers with stack, breeching, uptakes and fittings, surface condenser, generator and engine,

brake-rod connecting pins, brake-shoe keys, truck-bolster center plates, coupler knuckle pins, steel tubing, gaskets, mortising chisels, machine bits and bitstocks.

DREDGING.—Hawaii.—Bids were received as follows Dec. 1 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging a channel to the naval station, Pearl Harbor, Hawaii: Hoogs & Besler, 822 Fort St., Honolulu, $5,231,349; Hawaiian Dredging Co., Honolulu, $3,590,000; Bowers Southern Dredging Co., 2122 Mechanic St., Galveston, Tex., $4,365,312; R. A. Perry, 718 Merchants' Exchange Bldg., San Francisco, Cal., $3,662,848; American Dredging Co. of California, 95 Market St., San Francisco, Cal., $4,937,000; Coastwise Dredging Co., National Bank of Commerce Bldg., Norfolk, Va., $4,300,000; $112,500; $250,000; $175,000.

DUMP BARGES.—Panama.—Bids were received as follows Nov. 27 by the Isthmian Canal Commission, Washington, for furnishing four steel dump barges: Atlantic Equipment Co., 30 Church St., New York, $125,500, 185 days; William Cramp Sons Ship & Engine Co., Philadelphia, $71,600, 150 days; John H. Dialogue & Son, Camden, N. J., $96,000, no time stated (bid is for delivery afloat at Camden, N. J.); Fore River Shipbuilding Co., Quincy, Mass., $96,000, 150 days; Maryland Steel Co., Sparrow's Point, Md., $106,660, 145 days; Newport News Shipbuilding & Drydock Co., Newport News, Va., $100,500, 151 days; Pusey & Jones Co., Wilmington, Del., $110,000, 150 days.

SUPPLIES.—Panama.—Bids are asked by the Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., Dec. 21, for furnishing, under Circular No. 482, the following: Marine boilers, Portland cement, steel, iron, galvanized roofing, sheet brass, wire screening, bolts, nuts, washers, spikes, nails, tacks, repair parts for cars, wrought-iron pipe, pipe fittings, valves, cocks, steam gages, gage glasses, oilers, door hardware, shelf brackets, hasps and staples, turn-buckles, ball bearings, Manila and wire rope, wire, wick packing, hose, lathe chuck, reamers, pipe cutters, stock dies, saw blades, bit braces, hatchets, closet chain, basin plugs, scrubbing and paint brushes, pulleys, oars, headlights, scales.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consul at ———, ———. Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office, the matter may wholly escape attention.)

IRRIGATION.—Argentina.—It is planned by the Government to expend about $400,000 for the construction of a storage dam to insure the supply of water for irrigation purposes in the districts south of the Rion San Juan.

ELECTRIC LIGHTING. — New South Wales.—The committee on electric lighting of the Municipal Council, Sydney, N. S. W., will recommend that application be made to Parliament for power to borrow £250,000 ($1,217,500) for electric lighting purposes. The city electrical engineer has recommended the installation of additional equipment to cost about $406,000. The city building surveyor has reported that proposed extension of the Pyrmont generating station will cost about $226,800.

BRIDGE.—Belgium.—Bids will be received until Dec. 15, to be opened at noon, Dec. 18, at office of M. le Gouverneur du Hainaut, Mons, Bengium, for reawarding contract for construction of a reinforced concrete bridge over the Escaut at Escanaffles. Further information may be obtained from "M. Jaumin, Inspecteur provincial de la Voirie Vicinale, rue du Gouvernement, 15, Mons"; A copy of the specification and conditions may be procured for 60 centimes, and the plans for 6.50 francs, from the "Musee Commercial, Brussels," or from the "Gouvernement Provincial, Mons."

ENGINEERING MATERIAL PRICES.

TRACK FASTENINGS—

Pittsburg, f. o. b. cars—Angle bars, 1.65 to 1.75 cts.; spikes, standard sizes, 4½ × 9-16-in., at 1.70 cts. and smaller sizes at 1.80 cts. in carload and larger lots, with an advance of 5 cts. per 100 lbs. for less than carload, f. o. b. Pittsburg; bolts, square nuts, 2.65 to 2.75 cts.; hexagonal nuts, 2.80 to 2.90 cts.

RAILS, STEEL—

New York—at mill—New standard sections, $28; standard, second quality, $27 to $28; light sections, 12 to 14 lbs., $34 to $36; Per gross ton—Heavy melting steel scrap, $13 to $13.50; old steel rails, rerolling lengths, $15 to $15.50; relaying rails, $23 to $24; old iron rails, $18 to $18.50.

Pittsburg—Standard sections, at mill, $28; standard, second quality, $27 to $28; light rails, 25 to 45-lb. sections, $25; 20-lb., $26; 16-lb., $27; 12-lb., $28.

STRUCTURAL MATERIALS—

Pittsburg, f. o. b. mill—Beams and channels, 3 to 15-in., inclusive, 1.60 cts., net; I-beams over 15-in., 1.70 cts., net; angles, 3 to 6-in., inclusive, ¼-in. and up, 1.90 cts., net; angles, over 6 ins., 1.70 cts., net; angles, 3 × 3 ins. and up, less than ¼-in., 1.50 cts., base, half extras, steel bar card; tees, 3-in. and up, 1.65 cts., net; zees, 3-in. and up, 1.60 cts., net; angles, channels and tees under 3-in., 1.50 cts., base, half extras, steel bar card; deck beams and bulb angles, 1.90 cts., net; hand rail tees, 3 cts., net; checkered and corrugated plates, 3 cts., net.

Chicago—at mill—Beams and channels, 3 to 15-in., inclusive, 1.78 cts.; angles, 3 to 6-in., ¼-in. and heavier, 1.78 cts.; angles larger than 6-in., 1.88 cts.; beams, larger than 6-in., 1.88 cts.; zees, 3-in. and over, 1.78 cts.; tees, 3-in. and over, 1.83 cts.

New York—at tidewater—Beams, channels, angles and zees, 1.76 cts.; tees, 1.81 cts.; on beams, 18 to 24-in., and angles over 6-in., the extra is 0.10 cts.

PLATES AND SHEETS—

New York—at tidewater—Standard-sized plates—Sheared plates, 1.76 cts. to 1.86 cts.; flange plates, 1.86 cts. to 1.96 cts.; marine plates, 2.16 cts. to 2.26 cts.; fire-box plates, 2.65 cts. to 3.50 cts., according to specifications.

Pittsburg—mill shipment—Tank plates, ¾-in. thick, 6¼ ins. up to 100 ins. wide, 1.60 cts., base; blue annealed sheets, No. 10 and heavier, 1.80 cts.; Nos. 11 and 12, 1.85 cts.; Nos. 13 and 14, 1.90 cts.; Nos. 15 and 16, 2 cts. Box annealed, Nos. 17 to 21, 2.25 cts.; Nos. 22 to 24, 2.30 cts.; Nos. 25 and 26, 2.35 cts.; No. 27, 2.40 cts.; No. 28, 2.50 cts.; No. 29, 2.60 cts.; No. 30, 2.70 cts.; galvanized sheets, Nos. 10 and 11, 2.45 cts.; Nos. 12 and 14, 2.55 cts.; Nos. 15 and 16, 2.65 cts.; Nos. 17 to 21, 2.80 cts.; Nos. 22 and 24, 2.95 cts.; Nos. 25 and 26, 3.15 cts.; No. 27, 3.35 cts.; No. 28, 3.55 cts.; No. 29, 3.70 cts.; No. 30, 3.95 cts.

IRON—

Pig Iron:

At New York—tidewater—

Northern—			
No. 1 foundry	$17.50	to	$17.75
No. 2 foundry	17.00	to	17.50
No. 2 plain	16.00	to	16.50
Gray forge	15.50	to	16.50
Basic	15.50	to	16.25
Virginia—			
No. 1 foundry	17.10	to	18.15
No. 2 foundry	16.65	to	17.60
Basic	16.25	to	16.75
Southern—			
No. 1 foundry	17.50	to	17.75
No. 2 foundry	17.25	to	17.50
No. 3 foundry	16.75	to	17.25
No. 4 foundry	16.25	to	16.50
No. 1 soft	17.25	to	17.50
No. 2 soft	17.25	to	17.50
Gray forge	15.75	to	16.25
Mottled	15.50	to	16.00
At Chicago—f. o. b.—			
Lake Superior charcoal	$19.50	to	$20.00
Northern—			
Coke foundry, No. 1	17.50	to	18.00
Coke foundry, No. 2	17.00	to	17.50
Coke foundry, No. 3	16.50	to	17.00
Scotch, No. 1	18.00	to	18.50
Southern—			
Coke, No. 1	17.85	to	18.35
Coke, No. 2	17.35	to	17.85
Coke, No. 3	16.85	to	17.35
Coke, No. 4	16.35	to	16.85
Coke, No. 1, soft	17.85	to	18.35
Coke, No. 2, soft	17.35	to	17.85
Gray forge	15.85	to	16.35
Mottled	15.60	to	16.10
Malleable Bessemer	17.00	to	17.50
Standard Bessemer	17.90	to	18.40
Jackson County and—			
Kentucky Silvery, 6%	19.90	to	20.40
Kentucky Silvery, 8%	20.90	to	21.40
Kentucky Silvery, 10%	22.90	to	23.40
At Philadelphia—			
Eastern Pennsylvania—			
No. 2 X Foundry	$17.25	to	$17.50
No. 2 Plain	16.75	to	17.00
Virginia—			
No. 2 X Foundry	17.25	to	17.50
No. 2 Plain	17.00	to	17.25
Gray forge	15.75	to	16.00
Basic	16.50	to	17.00
Low Phosphorus	21.00	to	21.50
At Pittsburg—			
Prices all f. o. b. Pittsburg—			
No. 2 foundry	$15.40	to	$15.50
Gray forge	.....	to	14.90
Besemer iron	16.40	to	16.90
Ferromanganese	47.00	to	47.50
Ferrosilicon	69.00	to	70.00

Cast-iron Pipe:

New York—Carload lots, net tons, 6-in., at tidewater, $24.

Chicago—4-in. water pipe, $27; 6-in. to 12-in., $26; over 16-in., $25, with $1 extra for gas pipe.

MISCELLANEOUS MATERIALS—

Copper:

Lake, 14.37½ to 14.50 cts.; electrolytic, 14.12½ to 14.25 cts.; casting, 14 to 14.12½ cts.

Lead: New York, spot, 4.25 to 4.30 cts.

Spelter: New York, spot, 5.10 to 5.15 cts.

Tin: New York, spot, 29.50 to 29.80 cts.

Readers' Wants

If you are in the market for material, equipment or supplies, and fail to find it in our advertising pages, send us full particulars, and we will gladly put you in touch with the right parties.

CENTRIFUGAL PUMP.—Poultney, Vt.—The Mathews Slate Co., Poultney, Vt., writes that catalogs and prices are desired from manufacturers of centrifugal pumps.

CONCRETE BLOCK MACHINES.—Chicago, Ill.—Clarence Utt, 3643 South Hamilton Ave., Chicago, writes us that he is interested in concrete block machines and would like to have catalogs of different makes of molds and block machines.

STONE CRUSHING PLANT.—Boston, Mass.—The Old Colony Broken Stone and Concrete Co., 2 Kilby St., writes us that it is in the market for a stone crushing plant of 300 tons daily capacity, power plant, steam drills, etc.

SECOND HAND ROTARY PUMP.—Washington, D. C.—We are advised by O. H. Wood, Stoneleigh Court, Washington, D. C., that he wishes to communicate with parties having second-hand rotary pumps and hose for sale.

CONTRACTORS' AND BUILDERS' SUPPLIES.—Grand Rapids, Mich.—We are in receipt of advices from the Grand Rapids Structural Co., 18 Morrison St., Grand Rapids, Mich., requesting catalogs of general contractors' and builders' supplies.

ENGINEERING MATERIAL CATALOGS.—Tacoma, Wash.—Franklin F. Hopper, Librarian Tacoma Public Library, writes us to request manufacturers of engineering materials to send their catalogs, which will be placed in a position advantageous to the manufacturer.

STEEL RIMS.—Berkeley, Cal.—We are in receipt of a letter from Valdemar Arntzen, Berkeley, Cal., asking us to furnish names of firms capable of making special steel automobile wheel rims, made from ¼" to 5/16" sheet metal, with approximate diameters from 29" to 33".

CIVIL SERVICE EXAMINATIONS.

DRAFTSMAN, INSPECTORS.—Albany, N. Y.—The State Civil Service Commission will hold examinations on Dec. 12 for position of Junior Draftsman, Public Service Commission, First District, $720 to $1,200 a year.

The Commission will also hold, about Dec. 15, examinations for Instructors in Bakery, Carpentry, Machinery, Masonry, Printing and Tailoring, at the State Agricultural and Industrial School, Industry, N. Y. Each instructor, in addition to giving instruction and carrying on the work of the institution in his trade or industry, must live in the cottage with the boys constituting his class, and with his wife must manage the house and direct the work of the boys. Candidates, therefore, must be married men, and their wives must be competent to fill the position of Cottage Matron. Instructors receive from $720 to $780 a year and maintenance, and their wives as Matrons receive $300 and maintenance. Charles S. Fowler, Ch. Examiner. The last day for filing applications for these positions is Dec. 5.

HULL DRAFTSMAN.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Jan. 6-7, 1909, to secure eligibles from which to make certification to fill two vacancies in the position of Hull Draftsman, one at $100 and the other at $125 a month, in the Light-House Board, Department of Commerce and Labor, and vacancies requiring similar qualifications as they may occur in any branch of the service. The employment of these Draftsmen and others engaged upon marine construction work is dependent upon the amount of such work authorized by Congress, and therefore it is impracticable to state definitely how long their services will be required. The preparation of plans and specifications for vessels heretofore authorized will require their services for some months. Age limit, 18 years. Application Form 1312. Applications must be filed prior to closing hour on Dec. 26.

INDUSTRIAL NOTES.

ERNST WIENER CO., Hudson Terminal Bldg., New York, railroad specialists, announces that its Pittsburg office will in the future be located in the Union Bank Building, with Mr. John T. Cawley in charge.

THE WAGNER & WILSON MILL CO., of Monroe, Wash., has given an order to the Minneapolis Steel & Machinery Co., of Minneapolis, for one 18 × 36" twin Twin City Corliss engine for the new saw mill they are building at Monroe.

THE EXPANDED METAL & CORRUGATED BAR CO., St. Louis, Mo., announces that after Dec. 1, 1908, its firm name will be changed to the CORRUGATED BAR CO., and that the offices of the company will be removed to 1410-19 National Bank of Commerce Bldg., St. Louis.

ACCORDING TO PRESS REPORTS orders for 38 locomotives were received last week by the Baldwin Locomotive Works, Philadelphia. Of these, 25 are for the St. Louis Southwestern Railway and 13 for the Northern Pacific Railway. At present the Baldwin company is working 4,500 men on half time.

THE LYNCHBURG FOUNDRY CO., Lynchburg and Radford, Va., states that contract has been awarded for the erection of an addition to the special foundry of the Radford works, to be 50 × 125 ft., equipped especially for the vertical casting of flanged pipe in sizes from 3" to 60" diameter and 2 ft. to 20 ft. in length. Approximately $50,000 will be expended on this improvement.

A SUIT AGAINST THE McCALL FERRY Power Co. has been brought by the contracting firm of H. S. Kerbaugh, Inc., to recover sums aggregating $425,264. The work done by the contractor was the relocation and reconstruction of the Columbia and Port Deposit Ry. for a distance of some 15 miles, the work being made necessary by the construction of the McCall Ferry Power Co.'s great dam in the Susquehanna River.

AT THE ANNUAL MEETING of the stockholders of the Cement Products Exhibition Co., on November 18, in the Commercial Bank Bldg., Chicago, all of the old officers and directors were re-elected, with the exception that Mr. C. H. Wood resigned as Secretary-Treasurer and Director. Mr. C. A. Whyland, of the Elk Cement & Lime Co., was elected to succeed Mr. Wood as director and Mr. J. U. C. McDaniel was elected his successor as Secretary-Treasurer. The annual meeting was changed from Nov. 18 to the second Tuesday in May.

THE SULLIVAN MCHY. CO. announces that Sullivan Rock Drills, Air Compressors and Hammer Drills are now carried in stock at Spokane, Washington, by the United Iron Works Co., which has succeeded the Bradley Engineering & Machinery Co., as agents for the Sullivan Machinery Co. The United Iron Works Co. also represents the Sullivan Machinery Co. at Seattle, and will carry a stock of drills, compressors and supplies at No. 109 Main St. in that city. Mr. Austin Y. Hoy is the personal [illegible] of the Sullivan company in [illegible] headquarters at Spokane, [illegible] territory, with

MR. W. B. M'VICKER [illegible] Vice-President and Eastern [illegible] Dearborn Drug & Chemical [illegible] incorporated the W. B. [illegible] with offices in the U. [illegible] 115 Broadway, New York [illegible] plate laboratory and [illegible] of construction and will [illegible] Dec. 1. They will have [illegible] tics for general analytical [illegible] manufacture of high class [illegible] ciality will be made of [illegible] for treating boiler feed-[illegible] lic systems, also high g[illegible] personnel of the company [illegible] M. Eddy, Albert E. Ca[illegible] Hammill, William J. Schaf[illegible] ler and Frank J. Zink.

AT A MEETING held at [illegible] Allentown Portland Cement [illegible] ville, Berks County, Pa., [illegible] Mr. Chas. A. Matcham, [illegible] Manager of the Lehigh [illegible] Co., was elected Vice-Pr[illegible] eral Manager. The com[illegible] the company is making [illegible] part of the structural iron [illegible] Three 24" × 48" × 42" [illegible] condensing engines have be[illegible] with Robt. Wetherill & Co. [illegible] ter, Pa. Also four 8' × 12[illegible] three rotary dryers, and four [illegible] were ordered from the same [illegible] pected these works will be in [illegible] next June. The Fuller Engineering Co., of Allentown, Pa., are the Constructing Engineers.

ANOTHER LARGE TEXTILE MILL is being equipped with electric drive by the engineers of the Crocker-Wheeler Co., manufacturers of electrical machinery, of Ampere, N. J. A complete electric power plant, including motors, transformers and switchboards, has just been shipped by that company to the Windham Mfg. Co., of Willimantic, Conn. The equipment consists of nine 550-volt squirrel cage induction motors aggregating about 500 HP., which will be used to drive the machinery in the mill. The generating equipment consists of two 500 kilo-volt-ampere, 600 r. p. m. generators. The current will be generated at 600 volts, 60 cycles, 3-phase and will be transformed to 110 volts for lighting. The motors are all arranged for ceiling suspension. The transformers for the lighting system and the switchboard were also furnished by the Crocker-Wheeler Co.

THE ISTHMIAN CANAL COMMISSION invited bids in June for a large quantity of bronze globe and angle valves fitted with seats and discs that were capable of being renewed. Considerable competition resulted and after the authorities at both the Isthmus and Washington had considered the bids submitted by a number of manufacturers, they decided, recently, to place the order comprising upwards of seven thousand (7,000) valves, in sizes ranging from ¼ to 3 ins., for the Lukenheimer "Renewo" Renewable Seat and Disc Regrinding Valve. The manufacturer states that this valve is practically indestructible, inasmuch as every part that is subjected to any possible wear can be easily, quickly and cheaply renewed—a most desirable feature. These valves are guaranteed for 200 pounds working pressure and are manufactured by The Lunkenheimer Company, of Cincinnati, Ohio, having branches at New York, Chicago and London, Eng.

THE AMERICAN WATER SOFTENER CO., of Philadelphia, Pa., engineers, designers and manufacturers of water softening and purifying plants, reports among its important unfilled orders, several water softening plants for the Seaboard Air Line Railroad in Florida, for Joseph Brakeley, Freehold, N. J., Eureka Mining Co., Joplin, Mo., and the Ismert-Hincke Milling Co., Kansas City, Mo., and special softening apparatus for the city of Tulsa, Okla. Some of the unfilled orders for filtering plants are as follows: 1,000,000 Imperial gallons per day for the Consumers' Gas Co., Toronto, Ont.; 1,756,800 gallons per day plant for the Patchogue Mfg. Co., Patchogue, N. Y.; 250,000 gallons per day plant for Wm. H. Grundy & Co., Bristol, Pa.; 400,000 gallons per day plant for the Kanawha & Michigan Ry. and an addition to the filter plant at the State Hospital for the Insane, Danville, Pa., equal to a daily capacity of 1,900,000 gallons.

THE LARGEST CONSTRUCTION CONTRACT that has been let since the Chelsea fire has recently been awarded to Frank B. Gilbreth, general contractor, New York. The contract, which calls for the rebuilding of the entire box-making plant of the Atwood-McManus Co., which was destroyed in the second Chelsea fire, will involve the construction of a power plant with two very tall chimneys, a receiving building 345 ft. long, located on the eastern division of the Boston & Maine R. R., an office building, a stable 200 ft. long, a sawdust and kindling wood building, a 2-story factory building 350 ft. long by 200 ft. wide, and a warehouse 375 ft. long by 68 feet wide. The buildings, which are to be of heavy mill construction, resting on reinforced concrete foundations, will be so laid out that the raw lumber is transported by conveyors 20 to 25 ft. wide through the various buildings to emerge in the form of finished boxes. When the original plant was destroyed it contained over 6,000,000 ft. of seasoned lumber. The building site forms a right triangle with one side 800 ft. long, another 550 ft. long and the hypotenuse formed by the Boston & Maine R. R. About 500 men will be employed in the work. Lockwood, Greene & Co., of Boston, are the Architects and Engineers.

ACCORDING TO THE "CANAL RECORD," a contract has been let to the Western Wheeled Scraper Co., Aurora, Ill., for 200 steel dump cars of 12 yds. capacity. The first consignment will be delivered at Cristobal about Jan. 1, and the contractor has

agreed to finish the deliveries in March. Eight different firms submitted bids varying from $900, for a car lighter than that called for in the specifications, to $1,535. The contract was awarded at the rate of $948 for each car, a total of $189,600. The car contracted for is of the gravity type, similar to the 300 Western dump cars and the 500 Oliver dump cars now in use on the Isthmus. Some of the bidders, including the successful one, sent engineers to the Isthmus to study the conditions peculiar to the work here and, as a result of their investigations and of suggestions made by the Commission, the new cars will be superior to those already in use, although the latter have been satisfactory. One of the chief difficulties in the dump cars in use is the failure of the side door, and in the cars now being built special attention is paid to the design of the door in order to obviate the difficulties at present experienced. The draft sills of the new cars have also been made considerably heavier than those in the present cars. The improvements are simply those suggested by 2½ years' experience with this type of cars on various parts of the work. The center sills and latch rigging have also been improved. The new cars will be 21 ft. over the striking plates, with inside dimensions 19 ft. × 9 ft. 2½ ins. Their weight unloaded will be about 29,000 lbs. The clearance between the door and the floor when the car has been dumped will be 4 ft. 8 ins. The cars will be delivered knocked down and will be erected on the Isthmus.

THE NEW YORK TRIBUNE, under date of November 21, states: "The merchandise creditors' plan for the reorganization of the Westinghouse Electric & Manufacturing Company was declared operative yesterday by the readjustment committee representing the banking creditors of the company. This committee, which was headed by James N. Jarvie, has been holding a series of conferences at which the reorganization plan was thoroughly gone over, and their acceptance of it means a speedy termination of the receivership and an early return of the company to the stockholders. Following the announcement that the reorganization plan had been declared operative, Paul D. Cravath, counsel for the Westinghouse company, said that application would now be made for the termination of the receivership, and that the issue of new securities and the restoration of the business to the company was expected to be accomplished in the near future. The stockholders' meeting for the selection of the new board of directors and to take such other action as may be necessary for the carrying out of the new plan will be held in Pittsburg on Tuesday, as already announced. It is understood that the personnel of the new board of directors, which is to consist of 16 members, has been practically decided upon by the readjustment committee, but no announcement was made yesterday as to its members. It is known, however, that the new board will include representatives of some of the strongest banking interests in the country, which is regarded as assurance that the special requirements of the company in the future will be well cared for. It was inability to get funds which was directly responsible for the failure of the company a year ago. George Westinghouse will remain as president of the reorganized company, but his power will be curtailed. The management of the company, it is said, will be similar to that of the United States Steel Corporation. Mr. Westinghouse will have charge of the operating end of the company, leaving the financial end in the hands of a man who will occupy a place similar to that of ex-Judge E. H. Gary, of the United States Steel Corporation. This man, it is expected, will be J. W. Marsh, chairman of the merchandise committee. Although no official announcement has yet been made in the matter, it was learned yesterday that the receivers have accumulated more than $8,000,000 during their regime, from collections and the sale of manufactured products. The merchandise creditors' plan, which was declared operative yesterday, provided that the merchandise debt, amounting to approximately $4,000,000, was to be satisfied by the merchandise creditors surrendering their claims in exchange for new assenting stock of the company at par. Holders of the bank debt, amounting to $7,919,000, were to receive in exchange therefor one-half in convertible 5% bonds of the existing issue at par, and for the other half either 5% notes, running from four to six years, or assenting stock at par. A majority of the bank debt holders, it is said, elected to take assenting stock for 50% of their claims in place of the notes. The plan provided further that the stockholders subscribe to $8,000,000 of the new assenting stock at par. The funded debt, consisting of the convertible 5% bonds, 5% debenture certificates, three-year 6% collateral notes and ten-year 5% collateral notes, was not to be disturbed under the plan. The total amount of this funded debt is $29,000,000. The floating debt, which amounted to $15,000,000, has been disposed of by the issue of new stock for long term obligations, and the reorganized company will start with ample capital and no floating debt. Receivers for the Westinghouse Electric & Manufacturing Company were appointed on Oct. 23, 1907. They are E. M. Herr, Vice-President of the company; T. Hart Given, President of the Farmers' National Bank of Pittsburg, and H. S. A. Stewart, a retired capitalist. The failure of the company was due to overproduction and lack of working capital.

ACCORDING TO A RECENT ISSUE of "The Journal of Commerce," the following indications of renewed activity in the iron and steel trades are noted: "The activity has been mainly centered in the West, where car builders have placed larger orders for wheels and axles, and the manufacturers of the latter in turn have ordered an increased tonnage of billets. The axle plant of the American Bridge Company, which has been idle for over a year, is now going into commission, orders being received during the last few days for 7,000 tons of axles, while other orders are in sight which will keep this plant busy for some months at least. The Howard Axle Co., of the Carnegie Steel Co., has a capacity of 165,000 tons annually, or about 500,000 axles. The output of this plant is only moderately sold, but it is probably the freight rates to the Western territory which have made it expedient for the Steel Corporation to resume operations at Chicago. It is understood that the capacity of the Schoen Wheel Works, which now belong to the Carnegie Steel Co., has been largely sold for 1909; this plant will turn out about 200,000 wheels, or sufficient for 25,000 cars. As orders for railroad cars placed this year thus far have amounted to about 14,000 tons, it is evident that the car works are purchasing in anticipation of larger orders for rolling stock from the railroads. Within the last day or two an additional order for 2,000 steel wheels has been placed, and others are pending. It is thus evident that railroad buying is being gradually resumed, and the steel mills have reason to expect greater support from the transportation companies in the near future, although as yet orders for steel rails for 1909 rolling have scarcely begun. During the last few days contracts for about 10,000 tons of standard steel rails have been placed in the East, the largest contract being 4,000 tons for the New York, New Haven & Hartford Railroad, which contract went to the Bethlehem Steel Co. This mill has also taken 1,650 tons for Connecticut delivery. The other sales have been made up of small lots of 500 to 600 tons each, aggregating about 2,000 tons, the orders being placed with the Carnegie and Pennsylvania Steel companies. Orders for light sections have aggregated about 2,000 tons. There has been less activity in structural and fabricated steel, and very few of the orders now pending, upon which tenders have been made aggregating 100,000 tons, have been placed. Possibly this may be due to the strong influence which is being brought to bear on the independent mills rolling structural shapes to make fewer concessions in prices, but nearly all the business that has been placed recently has been on the basis of 1.40 cts. or less, down to 1.25 cts. for plain material. The principal new contract that has been placed this week calls for 5,000 tons of fabricated steel for a repair shop for the City Railroad. The contract was awarded to Post & McCord, 44 East 23d St., New York City, and the American Bridge Co. will supply the steel. The latter company also has booked an order for 1,000 tons for the St. Paul Terminal Railroad. From present indications the contracts taken by the American Bridge Co. this month will aggregate fully 50,000 tons, including the order for steel axles. This will be a little over half of the total contracts placed in November, while heretofore this year the American Bridge Co. has been obtaining less than 20% of the total business placed. Among the other contracts for fabricated steel for bridges and buildings placed within the last few days are 1,500 tons for a bascule bridge at Chicago for the Pennsylvania Railroad; the contract was awarded to the Toledo-Massillon Bridge Co., Toledo, Ohio. The Noelke-Richards Iron Works, Indianapolis, have taken an order for 700 tons of steel for a warehouse to be erected at St. Joe, Mo.; the Union Iron Works will supply 300 tons of steel for the Callahan Building at San Francisco; the National Wire and Iron Works have an order for 400 tons of steel for the Mercer County (Pa.) court-house. The receivers of Milliken Bros., of New York, have the contract for the Schiff apartment house in New York, requiring 500 tons of steel, while J. B. & J. M. Cornell, of New York, are to fabricate 1,000 tons of steel for the Kirkman soap factory. An order has also been placed for 500 tons of fabricated steel for a local schoolhouse. Inquiries are now out for 1,500 tons of steel for a bridge over the New York State Barge Canal. None of the large work pending at Chicago has been placed, but it is expected that the City Hall contract will be awarded soon. It is estimated that new plans for buildings and bridges now under way will call for 100,000 tons of steel, so that with the work already bid upon, the fabricating shops have before them work which will call for 200,000 tons of steel in the next few months.

TRADE PUBLICATIONS.

PORTLAND CEMENT.—Alpena Portland Cement Co., Alpena, Mich. Paper; 7¾ × 5¼ ins.; pp. 103; illustrated.

Information is given as to concrete construction, building blocks, sidewalks, etc., and there are several reports of tests of "Alpena" cement. Testimonials are also given, and the illustrations represent structures in which this brand of cement has been used.

DESIGN OF CONCRETE RETAINING WALLS.—Expanded Metal & Corrugated Bar Co., 925 Frisco Building, San Francisco, Cal. Paper; 5½ × 8½ ins.; pp. 28; illustrated.

Designing methods for reinforced-concrete construction are being dealt with in a series of bulletins issued by this company. No. 5 relates to retaining walls of the cantilever and buttress types.

ROLLING LIFT BRIDGES.—The Scherzer Rolling Lift Bridge Co., Monadnock Block, Chicago. Third Edition. Boards; 10 × 7 ins.; illustrated.

Since the first edition of this admirable descriptive catalog of the well-known Scherzer Rolling Lift Bridge, many added features have found a place in the design and many new bridges have been erected. This latest edition brings the catalog up to date; it is a useful compendium of the present development of the bascule bridge.

VENTILATING SKYLIGHTS. — H. E. Thompson Mfg. Co., Newark, N. J. Paper; 9 × 10 ins.; illustrated.

This booklet contains a description and illustrations of the Thompson ventilating skylight. Sectional cuts illustrate the action of the closing mechanism.

PORTLAND CEMENT.—Marquette Cement Mfg. Co., Marquette Bldg., Chicago. Paper; 6 × 9 ins.; pp. 4; illustrated.

This consists of copies of the reports of tests made on cement furnished for the new LaSalle Hotel, Chicago, which is now being built. A view of the 21-story structure is given.

CONCRETE SHINGLES AND TILES.—20th Century Tile Roofing Co., Chamber of Commerce Building, Chicago. Paper; 3½ × 6¼ ins.; pp. 16; illustrated.

The molding machine is described, together with the methods of making, curing and using the tiles. Some testimonials are given.

STEAM SEPARATORS.—Harrison Safety Boiler Works, Philadelphia, Pa. Paper; 3½ × 6 ins.; pp. 20; illustrated.

This booklet is entitled "Separator Talks," and contains explanations of the advantages of Cochrane steam and oil separators. Sectional views and tables of dimensions for several different styles are included.

STONE CRUSHERS. — Universal Stone Crusher Co., Cedar Rapids, Ia. Paper; 9¼ × 6 ins.; pp. 28; illustrated.

The crusher is of the jaw type, and was invented in Germany. There is very little description, but there are several views of the machine in the builders' shops and on construction works.

CONCRETE CONSTRUCTION. — Universal Portland Cement Co., Chicago. Paper; 6 × 9 ins.; pp. 10; illustrated.

Concrete fences, cattle pens, watering troughs and railway platforms at the Chicago stock yards are described briefly. There are views also of concrete buildings, bridges and walls in which this company's cement has been used.

SWITCHSTANDS.—American Valve & Meter Co., Cincinnati, Ohio. Paper; 8¾ × 11¼ ins.; pp. 8; illustrated.

This describes Anderson's "Economy" switchstands which are made with either rigid or automatic connections, and are operated by gearing. The ground lever is secured by a double automatic latch, which may be released by a foot lever or treadle.

FIRE BRICK.—Harbison-Walker Refractories Co., Pittsburg, Pa. Paper; 6 × 8 ins.; pp. 17; illustrated.

This booklet, entitled "What Are Your Lime Kiln Costs," explains the need and economy of careful selection of brick for use in lime kilns and discusses this company's facilities for providing a dependable output.

TURNED STEEL SHAFTING.—Geo. V. Cresson Co., 90 West St., New York City. Paper; 3½ × 6 ins.; pp. 6.

In addition to a brief statement of the merits of open hearth turned steel shafting, this booklet contains list prices of shafting from $1^{3}/_{16}$ to $4^{15}/_{16}$ ins. in diameter. Shafts can be furnished up to 16-in. diameter and 40-ft. length.

STEEL FLUMES.—T. C. Egleston, Sales Manager, 714 Ideal Bldg., Denver, Col. Paper; 9½ × 7 ins.; pp. 32; illustrated.

The illustrations show a number of installations of Maginis steel flumes, and also dimensioned drawings of timber substructure construction. The flumes are built up of galvanized sheet steel sections. The joints are made without the use of solder or rivets.

TIE-PLATES AND RAIL BRACES.—Beaver Dam Malleable Iron Co., Beaver Dam, Wis. Paper; 9¼ × 6¼ ins.; pp. 16; illustrated.

Various patterns of tie-plates are shown, some with bottom ribs or chisel-points, and with the top either flat or fitted with a shoulder. The braces include a special combined tie-plate and brace for high girder rails. Another specialty is a bracket or pedestal to support third-rail conductors.

BOILER FEED REGULATOR.—American Boiler Economy Co., North American Bldg., Philadelphia, Pa.

The purpose and manner of operation of the Copes boiler feed regulator and feed pump governor is very clearly explained in this booklet. Illustrations show plants in which these devices are used as well as diagramatic and sectional views which make plain the details of mechanism.

DRILLING MACHINES.—Cyclone Drill Co., Orrville, Ohio. Bulletin No. 1. Paper; 6¼ × 9 ins.; pp. 16; illustrated.

This bulletin describes the No. 10 "Cyclone" drilling machine for well drilling with hollow rod, cable or core tools. This machine is furnished with either steam or gasoline engine and may be arranged for use as a pile driver for small piles.

ADJUSTABLE WAGON BED.—The Mutschler Co., Goshen, Ind. Paper; 3½ × 6¼ ins.; pp. 28; illustrated.

The Mills wagon bed is adjustable for converting the wagon rapidly into a box body, a hay rack, flat-bottom rail, etc., for various uses on farm and other work.

STEEL CAR WHEELS.—Carnegie Steel Co., Pittsburg, Pa. Paper; 8 × 5½ ins.; pp. 46; illustrated.

The advantages of solid forged and rolled steel wheels are explained in this booklet. Dimensioned sectional views of these wheels as made for different purposes and photo-reproductions showing the stages of manufacture and rolling stock equipped with these wheels are shown.

CEMENT WORKERS HANDBOOK.—By W. H. Baker. The Ironton Portland Cement Co., Ironton, O. Cloth; 4¼ × 6 ins.; pp. 97.

This book deals with the preparation of mortar and concrete, and the methods of building concrete sidewalks, walls, culverts, posts, building blocks, etc. It is said to be prepared to meet the requirements of the workmen on such work.

HISTORY OF PORTLAND CEMENT.—United Kansas Cement Co., 811 Commerce Building, Kansas City, Mo. Paper; 6 × 9 ins.; pp. 12; illustrated.

This is the first number of a bulletin which the company proposes to publish monthly. It contains a brief history of Portland cement, a description of the company's plant and a suggestion for the coating of frame houses with sand concrete.

CONCRETE MACHINERY.—Burrell Mfg. Co., Chicago and Bradley, Ill. Paper, 5¾ × 8¾ ins.; pp. 48; illustrated.

The machinery includes concrete-block and brick molding machines, equipment for block-making plants, special covered wheelbarrows for carrying cement, and concrete mixers of the revolving drum type (driven by hand or by power). A large size of mixer is mounted on wheels and forms a combined concrete mixer and concrete dump cart, being drawn by a horse.

BUMPING POSTS AND TRACK SPIKES.—John M. Scott & Sons, Racine, Wis. Paper, 3¼ × 5½ ins.; pp. 12; illustrated.

The bumping posts are of steel construction. They include a high post to receive the blows from car couplers, and a pair of low posts clamped upon the rails to engage with the car wheels. Both types have spiral springs. The other specialties include the Racine nutlock and the Holdfast corrugated spike.

DRILLING, QUARRYING AND COAL MINING MACHINERY.—Sullivan Machinery Co., Railway Exchange Building, Chicago. Paper; 6 × 9 ins.; pp. 30; illustrated.

This number of the company's "Mine and Quarry" bulletin contains papers on test borings for bridge foundations, the use of channeling machines in quarry work and for the excavations for the Ashokan dam, and the use of coal cutting machines in mines.

HIGH DUTY TURBINE PUMP.—Lea Equipment Co., 136 Liberty St., New York. Bulletin G. Paper; 6 × 9 ins.; pp. 16; illustrated.

General and sectional views and a general description of the Lea-Degen multi-stage turbine pump are included in this bulletin. The results and curves of Professor Denton's test of one of the pumps are given. Lea-Degen pumps are made for heads of from 7 to 1,000 ft. with capacities of from 75 to 30,000 gals. per min.

SCREENING MACHINERY.—The C. O. Bartlett & Snow Co., Cleveland, O. Catalog No. 27. Paper; 6 × 9 ins.; pp. 32; illustrated.

This catalog contains photographic views of numerous actual installations of crushing, screening and washing machinery, giving an idea of the field covered by this company's products. Other illustrations show grading and bolting reels and installations of conveying machinery. A price-list of reel heads and spiders is included.

PRESSURE RECORDERS.—Crosby Steam Gage & Valve Co., 16 Dey St., New York City. Paper; 5 × 7¼ ins.; illustrated.

In this booklet are described Crosby pressure recorders for various purposes. One form is shown having in addition to the recording mechanism an outer circle of figures on which moves an index hand showing the pressure at the moment of observation as in an ordinary pressure gage.

GAS ENGINES AND PRODUCERS.—Weber Gas Engine Co., Kansas City, Mo. Brochure No. 58. Paper; 4 × 8¼ ins.; illustrated.

Weber gas engines are made in vertical units up to 400 HP. (three cylinder). Sectional and general views of these engines are accompanied by a brief description. The Weber up-draft, anthracite producer is also described.

STEEL LOCKERS.—The Berger Mfg. Co., Canton, O. Paper; 3½ × 6¼ ins.; pp. 11; illustrated.

This booklet contains illustrations and tables of measurements of single and double tier steel clothing lockers of various styles. This company also manufactures steel office furniture and filing cases.

RIVETERS.—Hanna Engineering Works, 820 Elston Ave., Chicago, Ill. Catalog No. 3. Paper; 6 × 9 ins. pp. 64; illustrated.

The mechanisms of the plain toggle, hydro-pneumatic and Hanna type riveters made by this company are clearly explained this catalog. Sectional views show the anatomy of each type. The catalog also contains lists of sizes and half-tone illustrations of complete riveters and of separate parts.

FURNACES AND FORGES.—Chicago Flexible Shaft Co., LaSalle Ave. and Ontario St., Chicago. Paper; 8½ × 11 ins.; pp. 55; illustrated.

The Stewart gas-blast furnaces for machine shop and tool work are shown in great variety. They include furnaces for tool tempering, rivet heating, case hardening, annealing, melting, brazing, etc. Prices are given. Rotary blowers and two forms of pyrometers are listed, and there is a table of colors and temperatures for tempering, annealing, etc.

KINGSFORD BOILERS.—Kingsford Foundry & Machine Works, Oswego, N. Y. Paper; 9 × 6 ins.; pp. 12; illustrated.

Sectional views and tables of dimensions of internally fired Scotch and "Ideal" boilers are published in this booklet. The "Ideal" boiler is a modification of the locomotive type and an evaporation of 10.26 lbs. of water per pound of coal is claimed for the 15-HP. size. This company makes Scotch boilers for 130 lbs. pressure up to 250 HP. and "Ideal" boilers for 100 lbs. pressure up to 200 HP.

HYDRAULIC CEMENT.—Utica Hydraulic Cement Co., Utica, Ill. Paper; 5¾ × 8½ ins.; pp. 8; illustrated.

This pamphlet relates to the use of Utica natural cement for sewers and street work, and contains a letter from Mr. N. P. Lewis, M. Am. Soc. C. E., favorable to this material. A larger pamphlet deals with cement in general and contains a number of testimonials, the first of which dates back to the use of Utica cement on the Illinois & Michigan Canal in 1846.

REINFORCED CONCRETE BUILDING CONSTRUCTION.—Interlocking Stone Co., Ninth and Clay Sts., Oakland, Cal. Paper; 9½ × 12½ ins.; pp. 4; illustrated.

This system of construction comprises concrete blocks for the faces of the wall, with an inner filling of concrete in which reinforcing bars are laid. There are vertical bars in the blocks and these are tied to the inner rods. The blocks have interlocking lugs. A concrete mixer of the open pan or pug-mill type is shown also.

CEMENT-WORKING MACHINERY.—The Cement Tile Machinery Co., Waterloo, Ia. Paper; 5½ × 9¾ ins.; pp. 32; illustrated.

The principal specialties are the Schenk machine for making concrete drain-tile and the Perfection concrete mixer; the latter is of the trough type, with a shaft carrying mixer blades. Molds, cars and conveyors for handling pipe, rotary sand screens and gasoline engines are listed. Views of tile-making plants are given, and there are several testimonials.

PORTLAND CEMENT.—German-American Portland Cement Works, 1526 Marquette Building, Chicago, Ill. Paper; 9 × 6¾ ins.; pp. 42; illustrated.

In addition to general information as to cement in concrete, this pamphlet contains the specifications for Portland cement adopted by the American Society for Testing Materials, and the specifications of the National Association of Cement Users for the manufacture and testing of concrete building blocks. About half of the pamphlet is devoted to views and drawings of concrete dams, bridges, floors, retaining walls, pipe, etc., in which the company's "Owlcement" has been used.

DESIGN OF CONCRETE REINFORCEMENT.—The Gabriel Concrete Reinforcement Co., 1210 Penobscot Building, Detroit, Mich. Paper; 9 × 6¾ ins.; pp. 118; illustrated.

The first half of this publication deals with the design of reinforced-concrete work, and the calculations for the amount of steel reinforcement, numerous formulas and tables being given. The remainder is devoted to views and brief descriptions of buildings in which the company's system of reinforced concrete has been used. There is also a description of a mine shaft lined in this way. A separate pamphlet describes a sugar warehouse built on this system.

OIL PUMPS.—Madison-Kipp Lubricator Co., Madison, Wis. Paper; 3½ × 6 ins.; pp. 4; illustrated.

This is a price list of repair parts for single and double oil pumps.

TESTS OF WIRE.—Wire Inspection Bureau, 29 W. 39th St., New York, N. Y. Paper; 3½ × 5¼ ins.; pp. 8.

This little pamphlet explains the purpose of the bureau in making factory inspections and tests on rubber-covered wire made under the National Electrical Code. The tests are described and there is a list of wire manufacturers which employ the bureau's service.

ROLLING LIFT DRAWBRIDGES.—The Scherzer Rolling-Lift Bridge Co., Monadnock Block, Chicago. Paper; 9½ × 12 ins.; pp. 4; illustrated.

A channel width of 200 ft. for the Chicago river bridges instead of the 140 ft. now being provided, is advocated in this circular, and the advantages of the Scherzer type of bridge are set forth. A separate sheet gives a list of ten rolling-lift bridges averaging 152 ft. span and $178,290 cost, and five trunnion bridges averaging 143 ft. span and $227,966 cost. All these span the Chicago River.

ELECTRIC LOCOMOTIVES FOR INDUSTRIAL HAULAGE.—The Jeffrey Mfg. Co., Columbus, O. Paper; 8 × 10 ins.; pp. 32; illustrated.

The locomotives include the independent storage battery system, the trolley wire system, and a combination in which the trolley current charges the battery on the locomotive. In addition there are small steel dump cars (as used for handling coal, coke, stone, etc.) fitted with motors and electrical apparatus. The motors, etc., are described, and information is given as to the care and maintenance of storage batteries.

ELECTRIC VEHICLES.—Rauch & Lang Carriage Co., Cleveland, Ohio. Paper; 6 × 10 ins.; pp. 40; illustrated.

A general description of the working parts and system of control used in these electric automobiles is followed by illustrations, descriptions and prices of the various types manufactured. A curve sheet is included, with curves plotted between miles per hour and total mileage on one charge for different makes of tires. Differences in total mileage as high as 40% (of the greater) are shown for different types of pneumatic tires.

THE NEW YORK, BROCKTON AND BOSTON CANAL.—Second Edition. Stiff paper; 9 × 11¼ ins.; pp. 82; illustrated. Compiled by Loyed E. Chamberlain and Edward B. Mellen, Brockton, Mass.

The company which issues this prospectus proposes an inland ship canal extending across Eastern Massachusetts from Fall River to Boston by way of Taunton and Brockton. The terminus at Boston would be on Fore River, near Weymouth. The prospectus is chiefly devoted to extracts from various publications and addresses relating to waterways and their advantages, and contains comparatively little concerning the canal route which it exploits.

SMOKELESS FURNACE.—Harris Smokeless Furnace Co., Nashville, Tenn. Paper; 10 × 7½ ins.; pp. 47; illustrated.

In this catalog appear sectional views and a U. S. Patent Office description of the Harris smokeless furnace. In this furnace, steam is introduced into the fire box through a "disassociator" located just above the fire door. A fire brick grillage extends from the top of the bridge wall to the under side of the boiler shell. The combustion chamber between the bridge wall and the rear of the shell is filled in even with the top of the bridge wall. The earlier form of this furnace, as described in Eng. News, Vol. XLIX., p. 400, appears to have been abandoned.

STEEL TIES AND RAIL JOINTS.—The Carnegie Steel Co., Pittsburg, Pa. Paper; 8 × 5½ ins.; pp. 60; illustrated.

The Carnegie steel tie of the I-beam type is dealt with at considerable length, including its rail fastenings of both the bolt and wedge types. A number of excellent half-tone engravings show the ties in use on several railways, including turnouts as well as ordinary track. Other engravings show different systems of street-railway track construction with these ties, as used in different cities. Tables of weights and quantities of material are given. The last few pages are devoted to the Duquesne rail-joint, the angle bars of which have stiffening flanges which extend beneath the rail.

GASOLINE TRACTION ENGINES AND AIR COMPRESSOR OUTFITS.—Abenaque Machine Works, Westminster Station, Vt. Two pamphlets. Paper; 6 × 9 ins., pp. 8 and 12; both illustrated.

The Abenaque Gasoline Traction Engine, briefly described in the first of these pamphlets, is made in 12 and 15-HP. sizes. It is provided with change-gear transmission giving three speeds, of one, two and three mi. per hr., and a reverse. The front wheels are mounted on knuckles like those commonly used on automobiles, making possible turns of short radius.

The air compressor outfit described in the second pamphlet consists of a 12 or 15-HP. gasoline engine connected by pinion and gear to an 8 × 8 air compressor, the whole being mounted on Z-beam frame carried by wagon trucks. If desired the engine may be disconnected from the compressor for other uses and a hoisting attachment is furnished.

PETROLITHIC PAVING.—The Petrolithic Pavement Co., 764 Pacific Bldg., Los Angeles, Cal. Paper; 9 × 6 ins.; pp. 88; illustrated.

The paving consists of the natural soil planed, sprinkled with crude asphalt, and then consolidated by a special tamping roller. The surface is finished with a gravel coating heated in the same way. The system has been used quite extensively, and a large part of the pamphlet is devoted to views of roads, streets and drives that have been paved in this way. The special machines used (spike-disk barrows, sprinkler carts and tamping rollers) are described and illustrated, and there is a table of quantities and costs. A smaller pamphlet contains testimonials and quotations from newspaper articles.

MOLDS AND MACHINERY FOR CONCRETE.—Miracle Pressed Stone Co., Nicollet Island, Minneapolis, Minn. Paper; 9 × 11½ ins.; pp. 142; illustrated.

Machines for molding the Miracle hollow building blocks, cement bricks, architectural details, etc., are shown in considerable variety. Among the special structures illustrated is a concrete silo, built of curved blocks. Molds for concrete pipe and tile are shown, and particulars are given as to the use of this material. Other machinery includes concrete mixers driven by hand or power (and including drum and trough types), tamping machines, gas engines, wheelbarrows, and the hand tools used in concrete work. Instructions are given as to the preparation of the concrete for the several purposes.

LUMINOUS ARC LAMPS.—General Electric Co., Schenectady, N. Y. Bulletin 4621. Paper; 8 × 10½ ins.; pp. 7; illustrated.

The above bulletin describes a luminous arc lamp for multiple circuits. This "Form 2" lamp is intended primarily for use in foundries, machine shops, freight houses, etc., where a large unit is desired, and combines high efficiency with low maintenance cost. The lamp is made for 110 and 220-volt, direct-current circuits, the 110-volt lamp being suitable for any line voltage from 100 to 125, and the 220-volt for voltages from 200 to 250. This company has designed also a multiple luminous-arc lamp for direct-current, power circuits and also for use as a head light on interurban cars and mining locomotives. The bulletin illustrates and fully describes all of these lamps.

WATER-WHEEL GOVERNORS.—The Lombard Governor Co., Ashland, Mass. Bulletin 110. Paper; 7 × 10 ins.; pp. 50; illustrated.

This interesting publication, although primarily a description of eleven types of water-wheel governors which have been extensively used, also gives a list of about five hundred typical water-wheel units grouped according to the type of governor employed, thus giving valuable data to consulting engineers and others who have the specifying of the type of governor to be used with new water-wheel installations. The descriptive matter of the governors referred to in this bulletin, although brief in each case, clearly sets forth the particular uses of the various machines. The illustrations are good and may be a revelation to those who have not followed the development of this particular class of machinery.

CONVEYING AND ELEVATING MACHINERY.—Skillin & Richards Mfg. Co., 127 Fulton St., Chicago. Cloth; 6 × 9 ins.; pp. 344; illustrated.

This is a very comprehensive catalog and price list of machinery, devices and appliances used in the mechanical handling of materials. Belt and clutch pulleys, rope sheaves, gearing, link belting, sprocket wheels, belting and shafting are all included. The conveying systems include belt, pan, flight and spiral conveyors, with their various accessories, such as trippers and loading hoppers. The specialties include package elevators and bucket elevators, and a portable belt conveyor (mounted on a truck) for such work as stacking coal. Spouting and hoppers for grain elevators are shown, and also corn shelling and cleaning machines. Lists of dimensions and prices are given in each case. Some of the illustrations show grain elevators and other plants which are equipped with this company's machinery.

For other Proposal Advertisements see pages 43, 44, 45, [illegible] 50, of Advertisements and Construction News page 204.

SEALED PROPOSALS [illegible] indorsed "Proposals for Dry Dock, [illegible] be received at the Bureau of Yards [illegible] Docks, Navy Department, Washington, [illegible] 11 o'clock a. m., February 13, 19[illegible] and then and there publicly opened, for [illegible] constructing a concrete and granite dry dock approximately 1,140 feet long, [illegible] feet wide and 35 feet deep, at the Navy [illegible] Station, Pearl Harbor, Hawaii. Plans [illegible] specifications can be had at the Bureau [illegible] will be furnished by the Commandant [illegible] the naval station named, after [illegible] upon a deposit of $100, [illegible] their return. R. C. HOLLY, [illegible] of Bureau. December 1, [illegible]

OFFICE OF THE CHIEF OF ENGINEERS War Department, Washington, Dec. 1, 1908.—Sealed proposals for furnishing and delivering power hoists will be received here until 11 [illegible], Dec. 31, 1908, and then publicly opened. Information furnished on application. FREDERIC V. ABBOT, Lieut.-Col., Engrs.

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